BC 161
.P5 T7

THE LIBRARY OF CONGRESS

THE LIBRARY OF CONGRESS

THE

BOOK OF ANALYSIS,

OR

A NEW METHOD

OF

EXPERIENCE;

WHEREBY THE INDUCTION

OF THE

NOVUM ORGANON

IS MADE EASY OF APPLICATION TO

MEDICINE, PHYSIOLOGY, METEOROLOGY, AND NATURAL HISTORY; TO STATISTICS, POLITICAL ECONOMY, METAPHYSICS, AND THE MORE COMPLEX DEPARTMENTS OF KNOWLEDGE.

Ut scilicet mens per artem fiat rebus par.

De Augmentis Scientiarum.

BY TWEEDY JOHN TODD, M. D.

OF THE ROYAL COLLEGE OF PHYSICIANS OF LONDON, &c. &c.

LONDON:

JOHN MURRAY, ALBERMARLE STREET.

MDCCCXXXI.

BC 161
.P5 T7

THE LIBRARY
OF CONGRESS
WASHINGTON

LONDON:
GAULTER, Printer, Lovell's Court, Paternoster-Row.

TO

JAMES CLARK, M. D.

PHYSICIAN IN ORDINARY TO HIS ROYAL HIGHNESS PRINCE LEOPOLD OF SAXE COBURG, AND PHYSICIAN TO ST. GEORGE'S INFIRMARY, &c. &c. &c.

My Dear Friend,

A work having for its object to increase the certainty of Medicine, might, with peculiar propriety, be inscribed to a scientific and conscientious physician, the whole tenour of whose life has been distinguished by an anxious solicitude for the advancement of the art: But had I not so

fair a reason for dedicating such a work to you, I should still be desirous of seizing this occasion to testify the deep sense I entertain of the kind partiality, which, since our first acquaintance, you have ever felt for me, and the value I set upon the steady friendship with which, you have continued to honor me.

Your faithful

And obliged Friend,

TWEEDY JOHN TODD.

Brighton, July 10, 1831.

PREFACE.

In venturing to submit to the eye of the Public the following little work on the subject of Induction, I am not aware that I could offer a better apology than the reasons which are stated in the following passage from the writings of the most sensible and the most enlightened of the philosophers, who have distinguished this age. "In the mechanical arts, it is well known, how much time and ingenuity are misapplied, by those who acquire their practical skill, by their own trials, undirected by the precepts or examples

of others. What we call the rules of an art, are merely a collection of general observations, suggested by long experience, with respect to the most compendious and effectual means of performing every different step of the processes which the art involves. In consequence of such rules, the artist is enabled to command the same success in all his operations, for which the unskilled workman must trust to a happy combination of accidental circumstances; the misapplications, too, of the labours of one race are saved to the next; and the acquisition of practical address is facilitated, by confining its exertions to one direction.—The analogy is perfect, in those processes which are purely intellectual, and to regulate which, is the great object of logic. In the case of individuals, who have no other guide to direct them in their inquiries than their own natural sagacity, much time and ingenuity must inevitably be thrown away, in every exertion of the inventive powers. In proportion, however, to the de-

gree of their experience and observation, the number of these misapplications will diminish; and the power of invention will be enabled to proceed with more certainty and steadiness to its object. *The misfortune is, that as the aids, which the understanding derives from experience, are seldom recorded in writing, or even described in words, every succeeding inquirer finds himself, at the commencement of his philosophical pursuits, obliged to struggle with the same disadvantages which had retarded the progress of his predecessors.* If the more important practical rules, which habits of investigation suggest to individuals, were diligently preserved, each generation would be placed in circumstances more favourable to invention than the preceding; and the progress of knowledge, instead of cramping original genius, would assist and direct its exertions."*

It is precisely one of these *practical rules,*

* Stewart's Philosophy of the Human Mind.

suggested to me in the course of some analytical inquiries, which I now propose to place upon record, not, however, unaccompanied by a confident hope, that, worked out by more practised hands, it may be found susceptible of ameliorations which may ultimately tend very materially to improve our Method of Experience. Nor can I help indulging a wish, perhaps rather than an expectation, that even, as an example, this publication may have this beneficial result,—that it may call forth, from the portfolios of the learned, many practical expedients which their experience may have taught them, and which, I very much suspect, only remain unknown from a notion of their unimportance.

Brighton, August 17, 1830.

CONTENTS.

INTRODUCTION.

The Induction of the Ancients—The Induction of the Moderns before Lord Bacon—The philosophers who made use of Induction before Lord Bacon utterly ignorant of their *instrument*—How Lord Bacon was probably led to his great discovery—The present neglect of Induction—Different denominations of Inductive Philosophers, *Synthesists*, *Specialists*, *Analysists*—Causes in which the neglect of Induction has originated—The mind naturally averse to rules of art—A bias in favour of natural or intuitive Induction—A regular method of Induction opposed to Practical Tact—Excuse in the present imperfect state of Induction—Was left unfinished by Lord Bacon—Different influence of the neglect of Induction upon the different departments of knowledge—Prejudicial consequences resulting from the neglect of Induction, *waste of experience*, *false facts*, *false doctrines*. p. 1—22.

CHAP. I.

OF A NEW METHOD OF INDUCTION, PERFORMED BY TABULÆ INVENIENDI.

Method of *Tabular Analysis*, by combining the use of Tables and Signs—*Translation of circumstances into signs*—Manner of

performing this process—*Classification by affirmative circumstances*—Form I. *a.*—nature of this operation—*Classification by negative circumstances*—Form II.—manner of performing this process—nature of this process—Modifications of the Signs—Recapitulation—Synthesis—Form III.—facilities afforded by this process—Method of extracting the Induction by *Rectification of the Signs*—Nature of this operation—*Recapitulation of the Processes*—Rules for performing the different Processes—Precautions necessary in performing the different Processes. p. 22—57.

CHAP. II.

The method of Induction by Classification compared with the Method of the NOVUM ORGANON. I. Lord Bacon's precepts for the discovery of *forms*—The great DICTUM of the Inductive Logic—His method of performing the process of Induction—His method compared with the *method of classification*—II. Lord Bacon's views of completing the Philosophy of Experience. p. 59—74.

CHAP. III.

OF CERTAIN ADVANTAGES PECULIAR TO THE *Method of Induction by Classification.*

I. It places many branches of knowledge within the grasp of Induction which the ordinary method cannot effect—It connects general principles more intimately and correctly with individual cases—Is saving of experience—Elicits *prerogative* instances—Is capable of comprehending any number of instances—II. Affords all the facility which arises from the operation being performed by determined rules—Guards the mind from the influence of *idola*—The advantage of signs instead of words.—III. It answers habits of close and accurate observation—And promotes those of method, of clear and perspicuous arrangement—And represents the natural operations of the mind. p. 75—85.

CHAP. IV.

METHODUS CONTABULANDI, or modifications of the Tables of Analysis to suit different subjects of Investigation. p. 86—104.

CHAP. V.

APPLICATION OF THE METHOD OF INDUCTION BY CLASSIFICATION TO PARTICULAR SUBJECTS.

Sect. I. *Medicine.*—The right method of studying medicine —Plan of an *Analytical Hospital*—THE BOOK OF MEDICAL ANALYSIS, or *Guide for studying faithfully from Nature.* 105—154. Sect. II. *Physiology*—Its difficulties—Want of a better mode of Analysis. 155—159. Sect. III. *Phrenology, Animal Magnetism, and Omoiopathic Medicine*—Their claim to an attentive consideration—Mode of examination by Tabular Analysis. 160—161. Sect. IV. *The Useful Arts, Chemistry, and Meteorology.* 164—168. Sect. V. *Classifications of Natural History*—The Tabular Analysis likely to abbreviate and facilitate the process of Systematic Arrangement. 169—171. Sect. VI. *Analysis of Testimony.* 172—177. Sect. VII. *Statistics and Political Economy.* 178—183.

Conclusion. 184—186.

THE

BOOK OF ANALYSIS.

INTRODUCTION.

"Causa vero et radix fere omnium malorum in scientiis ea una est: quod dum mentis humanæ vires falsò miramur et extollimus, vera ejus auxilia non quæramus."

THEY who have pleasure in searching for the origin of modern science in the learning of the ancients, might possibly discover many traces of the philosophy of experience, and some examples of the use of induction. They might find reason to believe, that the earliest of their philosophers felt and understood the full importance of the great cardinal truth, afterwards announced in the first aphorism of the *Novum Organon.* They might find that Hippocrates, who by some is supposed to have been of the number of their disciples, formally asserted it, that the empirical physicians maintained it as the fundamental canon of their doctrine, and, if they should think it worth their pains to inquire with what instrument the great founder of the art of physic constructed

his more finished works, they might probably be led to conclude that it could be no other than a method of induction: for unquestionably the fairest specimens of it known before the revival of letters, are those which he has left us. But pursuing their researches, they would also find, that these germs of the true philosophy, and probably many more which have merged in the stream of time*, failed to open to the ancient world the certain and the only road, which leads infallibly to the knowledge of nature.

In the same manner, before the time of Lord Bacon, some modern philosophers of our own, as well as of foreign nations, insisted on the necessity of an appeal to experience, and presented to the world a few examples of the correct use of induction. But it seems by no means a groundless apprehension, that the same dark fate which eclipsed the early dawn of the experimental philosophy of antiquity, might also have extinguished its first faint glimmerings in later times, had not the greatest, because the truest of all philosophers, appeared upon the horizon, who, from his vast and comprehensive mind, shed those rays of clear and steady light, which establishing exclusively the principle of induction, laid open the path of science to every inquirer. What might have been the

* Tempore ut fluvio leviora et magis inflata devehente, graviora et solida mergente.

history of induction had Lord Bacon never existed, it may seem idle now to conjecture, but it is very obvious there could have been no security for it, at any time, unless founded firmly upon principle. All that was known of it only by example, might soon have been effaced by the dogma of any splendid sophist, and, to bring the supposition nearer to the fact, let us imagine that Descartes had occupied the place of Bacon, we shall then understand the peril which hung over the philosophy of experience, and be better able to appreciate the obligations we owe to its great discoverer. To institute, therefore, any comparison between the merits of Lord Bacon and Galileo or of any other experimental philosopher who preceded him, as since the time of Hume has occasionally been revived, is altogether unwarrantable, and betrays a total misconception of the nature of the services which both have rendered to the cause of science.

The philosophers who made use of the method of induction before Lord Bacon, were utterly ignorant of the nature of the instrument which they employed. Like travellers whom chance may have led to an unknown country, but neither knowing the road by which they went or by which they returned, they could afford no help for conducting others; and we ought not, therefore, to be much surprized, that they did not always obtain credence for the extraordinary things they report to have seen. But Lord Bacon, like the scientific

navigator, sailed by the chart, and returning with a map of the country whither he had been, gave every one the power of following his tract, or of verifying his narrative. For being the first who ever had a conception of the instrument of induction, he explained its nature, showed its powers, and gave a rule for using it, and by this rule he placed within the reach of the meanest capacity resources which theretofore had been at the disposal only of minds highly gifted by nature. If we consider for a moment the nature of this instrument, the general use of which he may be said to have bestowed upon mankind, it will be easy to comprehend the magnitude and the importance of the discovery; for being no less than the most powerful organ of human reason, the art of invention, he has only explained its real character in calling it the mother-art of all arts, the mother-science of all sciences,—"ars artium, scientia scientiarum." And, if he be the greatest benefactor of mankind who has taught the right use of the greatest power with which it has pleased God to endow human nature, Lord Bacon pre-eminently deserves that title: for revealing to man that the knowledge of nature was the power of art, "interpretatio naturæ, regnum hominis," he disenthralled the human mind, and led it forth from its "narrow house" of confinement, to exercise and to enjoy the high privileges which have been bountifully ordained for it.

How Lord Bacon was led to his great discovery, the learned seem not to be well agreed. It is, however, generally admitted, that it was not, *à priori*, from any metaphysical analysis of his ideas concerning the nature of the process, but rather from reflecting upon the errors of his predecessors. Speculating upon such a subject, we ought to keep in mind what has been very properly observed of the history of the mechanical arts, and what may equally be said of every art connected with the immediate wants of mankind, that men are familiar with them long before the idea occurs of enumerating or describing them, or even of examining very closely the nature and limits of the aid they are capable of affording. And accordingly Lord Bacon informs us, that although he was the first to enter upon this career,* he did not invent any art which had not existed before, but, on the contrary, that his manner of philosophizing was a natural operation of the mind,† which it follows of its own accord, unless led astray by the feelings or biased by pre-conceived opinions; and that patient, sober, and cautious understandings do sometimes of their

* Atque in hac re planè *Protopirum*, et vestigia nullius secutum, neque hæc ipsa cum ullo mortalium communicantem, et *tamen veram viam constanter ingressum*, et *ingenium rebus submittentem*, hæc ipsa aliquatenus, (ut existimamus) provexisse.

† Est enim interpretatio, verum et naturale opus mentis, *demptis iis quæ obstant*.

own natural suggestion, proceed upon it.* Now Lord Bacon himself was eminently distinguished by this character of mind, and possessing a strong natural taste for physical researches, seems to have very much exercised himself in them. This was also probably very much encouraged by particular circumstances. Amongst these may be mentioned the state of his health habitually infirm, which, rendering him in some degree his own physician, had a tendency also to favour such pursuits. His accurate knowledge of the works of the ancient writers on medicine, would seem to give some support to this opinion. But whether this be well founded or not, he seems to have been at all times more or less occupied with one inquiry or another, so that the habits of his mind, contrary to the habits of his profession, were necessarily inductive. It appears, therefore, not improbable, that in making the discovery of induction, he only detected the process followed by his own reason, and by comparing this with the method of the schools, he found it to be the only true and correct one. In this way it seems reasonable to conclude, that the discovery of induction was the result of the method of experience; nor does there seem any other possible manner of generalizing and establishing a common principle of natural reasoning.

* Intellectus sibi permissus in ingenio sobrio et patienti et gravi (*præsertim si a doctrinis receptis non impediatur*) tentat nonnihil illam alteram viam, quæ recta est.

The present state of the arts and sciences, which are the fruits of the Baconian philosophy, so fully declares the inestimable benefits which it has conferred upon the human race, that it may appear unreasonable not to rest contented with the progress which has already been made under its auspices. Perhaps indeed the easy success which has attended the use of the inductive method, may afford a reason for explaining why the method itself has not received those improvements of which it is susceptible, and why consequently for want of its correct application, many branches of knowledge remain comparatively an uncultivated waste. For it must certainly be admitted, that although all who pretend to the study or to the imitation of nature, profess their faith in the philosophy of experience, only a few observe with fidelity the rules and precepts of the inductive logic. Indeed so great a latitude do those whose pride it is to be called the followers of Bacon, allow themselves in the use of his method, and so great a diversity do they present in their manner of philosophizing, that amongst his disciples many various denominations might be distinguished, certainly not differing less from each other than the *Dogmatists,* the *Methodists,* or the *Empirics* of antiquity. Thus to the first might be compared the *Synthesists* of the present day, known by their overweening confidence in general principles hastily deduced, who prefer attributing effects

to causes already known, but are ever impatient in the search of new ones. The epithet which Lord Bacon applied to their ancient prototypes, still fairly attaches to them, for, from very small materials of experience they, like the spider, spin their webs of theory from their own entrails. In the same manner the modern *Specialists* are faithful representatives of the old *Empirics*. They are equally distinguished by their cautious, if not obstinate, adherence to particular facts, never venturing to draw a conclusion or to follow out a principle. They simply collect their store of single cases which, like the ant, they use in their original crude state, without the elaboration or refinement which the mind has the power of imparting. Between these two extremes, there are of course many other denominations who deviate more or less widely from the axioms of their master, but it must be confessed that most men lean to the one or the other, few in the spirit of true *Analysists* pursuing the safe middle way. And it is indeed worthy of remark, that these leading sects, under one name or another, may be traced through all the history of philosophy, a distinction which for wise reasons, may have its foundation in the original constitution of the human mind. But however this may be, it must under all circumstances be allowed, that such palpable deviations from the rules of philosophizing, ought not to exist among disciples of the same master; for,

either the inductive philosophy is not a safe guide, or its followers give themselves unauthorized license in the use of it. The *Specialists,* indeed, if they strictly adhere to their dogma, cannot in fact be said to employ the method of the true experience, but rather the method of that art which Lord Bacon has called the "*experientia literata,*" and which he significantly terms, "sagacitas potius et odoratio quædam venatica, quam scientia."

However strange therefore it may seem, it is still not the less true to say, that whilst it is the character of the present age to appeal directly to experience,—to observe the spontaneous workings of nature, and to ask questions of her when she is silent,—it is also distinguished by a remarkable latitude in the use of induction, and by a culpable over-confidence in the powers of natural reason. The answers of nature are hastily anticipated instead of being patiently waited for, or heard impatiently and interpreted falsely. But, as a very philosophical physician has, with great nicety of expression, observed, "la natura non vuol esser sopraffatta, vuol, esser sentita; ama di esser conosciuta, ma é gelosa di esser capita."* A confidence in the analytical nature of experiment and the success which has been already obtained by it, have no doubt, in a great degree, promoted these

* *Cotugno.* Spirito della Medicina.

loose habits of philosophizing; but this resource is becoming every day more exhausted, and a faithful analysis of facts every day more necessary, so that it does not seem two much to say, that a close and rigorous induction, is at the present moment, more called for, to ensure and to advance the progress of science, than the continued accumulation of either observations or experiments.

It might be well to know something more particular of the causes in which this latitude, or rather neglect of induction, has originated, and why men prefer the rude undisciplined powers of the mind to the strength and ease which is derived from their cultivation. In the performance of any physical operation, men most greedily seize upon any assistance which the ingenuity of the arts can supply, but cannot bear to conform to any rule, however much it may contribute either certainty or facility to the operations of the mind. The principal reason to be assigned for this, must be sought for in the natural constitution of the human mind. The wishes and the feelings of man lead his understanding. "Intellectus humanus luminis sicci non est. Quid enim mavult homo verum esse, id potius credit. Rejecit itaque difficilia ob inquirendi impatientiam; sobria quia coarctant spem; altiora naturæ propter superstitionem; lumen experientiæ propter arrogantiam, et fastum, ne videatur mens versari in vilibus et fluxis; paradoxa propter opinionem vulgi." In this aphorism Lord Bacon specifies nearly all

the motives why men prefer the vague and undefined art of their own contrivance, which allows them to shape their opinions to their feelings, rather than the restraint of a fixed and certain method, which checking their hasty assumptions forbids them to outstep their data.

There are, however, many men grey in observation, who, though they would be ready to admit most fully the prejudicial influence of these causes upon the sober exercise of the judgment, would yet be disposed to contend, that the natural art of induction, which is the result of habits of personal experience, is far preferable to any regular method which either education or the experience of others has the power of imparting. Now examining into the soundness of this objection and considering what it is really worth, it may seem almost unnecessary to remind those who are of this way of thinking, that there is no difference of opinion as regards the nature of the instrument which is to be used, but only as regards the best way of acquiring the use of it. The most consummate practical tact, which has been beautifully explained to be the result of "the intuitive habits of silent induction," is precisely a self-taught or natural method of experience, and, although it must be allowed that there is an adroitness and ease to be acquired by practice, in the use of even the most perfect and finished instrument, which no

instruction can convey, still it does seem unaccountable for that reason alone to prefer the home-made tool of one's own contrivance to the most correct instrument which the ingenuity of man has been capable of producing. It is the husbandman who prefers his own rude flail to the convenient implements of modern agriculture. And, were it possible that every man could prepare for himself a method for making a right use of his experience, sufficiently well adapted to his purpose, it must not be forgotten, that it is only after many years of labour and disappointment that he acquires it, through error and failure as well as success, of all which his tact may be considered the last result of the eliminating process of repeated inductions. Thus he only becomes sagacious and expert at the expense of much toil and many sacrifices, and frequently, as in the case of the statesman, the legislator, and the physician,* at others cost as well as his own. Nor do the disadvantages of preferring this home-spun method of a personal induction to one common principle available to every one and applicable to all circumstances, terminate here, for it is only at the eve of life, that this talent has reached its full maturity, and it must necessarily die with each individual, without contributing to the common benefits of his fellow creatures.

* Aliorum salute, aliorum interitu, perniciosa discernentem â salutaribus.

There are no doubt some, however, who may be inclined to argue on this side of the question from a notion that a regular method of induction is opposed to the developement of practical tact. To a certain extent perhaps this may be the case. As, for sake of comparison, one who, in describing a circle, has never accustomed himself to make use of a pair of compasses, may describe it more accurately with his naked hand, than the person who has habituated himself to depend upon their assistance. I am however disposed to think, that few will be found to urge such a reason against the use of compasses, or any other mechanical contrivance, which enables an operation to be performed with safety or facility. But if there may be found some who would push their opinion to this extreme case, they would not be more inconsistent than those who object to teaching and cultivating a regular method of correct and careful induction by which men may profit by their common experience, but who willingly confide in individual resources, which only a few possess, and of which a still smaller number know how to avail themselves.

But though it be impossible to allege any good reason for neglecting the cultivation of induction, some excuse might be found in the imperfect state in which we now possess it. It may reasonably be pleaded that it is by no means adapted to the present state of our knowledge, and that its application to many subjects is a matter of the greatest difficulty.

That the inductive philosophy was left by its great expounder in an unfinished state, must certainly be allowed. Since his time the greatest changes have taken place in almost every department of science and of art, but without any corresponding modification in the process of induction. Every one, therefore, in order to make a proper use of it, is obliged to mould and adapt it to his own case. It is also generally admitted, that Lord Bacon had not a very accurate notion of the boundaries which confine philosophical investigations, but, that directing his views to objects beyond the reach of human knowledge, he encumbered his precepts with superfluous and embarrassing rules. Indeed it cannot be denied that his rules are more particularly intended for the discovery of those things which philosophers of later times consider impossible for the human mind to compass, than of those which come within the bounds of rational and attainable knowledge. Thus the discovery of the essential forms of things and of their abstract qualities, were the subjects to which he devoted his more particular care, and although the principle for conducting the discovery of these, does not differ from that suited to the investigation of physical causes, yet this circumstance tended considerably to embarrass the process with some obscure terms and unnecessary distinctions which may no doubt have raised an impediment to the general use of his method. "If," as observes Mr. Du-

gald Stewart, "he had perceived as clearly as Barrow, Berkeley and Hume, and many others have done since his time, that there is not a single instance in which we are able to trace a necessary connexion between two successive events, or to explain in what manner the one follows the other, as an indispensable consequence, he would have been naturally led to state his principles in a form far more concise and methodical, and to lay aside much of that scholastic jargon by which his meaning is occasionally obscured." What form might have suggested itself to his powerful and penetrating mind, impressed with the conviction of our inability to remove the veil which nature has thrown over the mysterious union of cause and effect, we may not now conjecture, but it must ever remain matter of deep and serious regret, that the same mind which developed and explained the great principles of the philosophy, should not have also laid down the definite rules of its application as an art.

Each of the foregoing causes have no doubt had their full share in giving rise to a latitude in the use of induction equally incompatible with the interests of science and the usefulness of art. It may, however, be worth while to consider the particular manner in which this has operated, and the different effects it has had upon the different branches of knowledge.

It is very plain, that all the different branches of

knowledge do not stand equally in need of induction. In those sciences which admit of the application of the mathematics, if the adaption of a formula be made correctly, the possibility of error is removed. The method of the mathematics is so strictly logical, that so soon as any class of phenomena is represented by them, their relations to each other are precisely determined, and the consequences deduced are necessarily true; so that any fact predicted by the calculus is more certainly true, than the same fact known either by observation or induction. "Le calcul commande pour ainsi dire à la nature" because, "il en détermine les phénomènes plus exactment que l'observation ne peut les faire connoître."* This department of knowledge is therefore, in the main, fortified against the false steps of induction, and has consequently suffered comparatively little from its abuse.

It is also the nature of experiment, although in a different way, to render those branches of science which proceed upon it, as also the arts which are only a repetition of experiments, relatively independent of the inductive process. For, in the first place, by means of experiment, a kind of practical induction is carried on, almost visibly submitted to the perception of the senses, which promotes and suggests conclusions as it were

* *Cuvier.* Regne Animal.

mechanically, and checks the errors to which the abstract operations of the mind are constantly exposed. And, in the second place, the great and leading advantage of experiment, is the power which it bestows of creating facts, as it were, at pleasure, by which means the mind may select only those luminous facts, called by Lord Bacon, *prerogative instances.* A few of these, he tells us, speak more plainly than a multitude of common facts, so that a consequence may be deduced inductively from the comparison of a few examples by a simple intuitive act of the judgment.* Here, therefore, there is little room for an abuse of induction, and it is, consequently, in this department of knowledge that the greatest progress has been made by the method of experience.

But when pure observation becomes exclusively the purveyor of our knowledge, the case is far otherwise. Here we must accept, without choice or selection, whatever nature or accident may please to present.† There is no power of varying their

* Sunt enim *instantiæ prerogativis istis* insignitæ et donatæ *animæ instar inter vulgares instantias comparenti:* et, ut ab initio diximus, paucæ illarum sunt vice multarum.

† *Observationes* fiunt spectando id quod natura per se ipsam exhibet; hujusmodi sunt observationes pertinentes ad astronomiam et historiam naturalem.

Experimenta fiunt ponendo naturam in eas circumstantias in quibus debeat agere et nobis ostendere id quod quærimus; quod pertinet ad physicam experimentalem. Porrò et ferro et igni utimur, et dissolvimus per vim compagem corporum, potissimùm in chemiâ, et naturam quodammodo velut torquentes, cogimus revelare sua secreta.—*Boscovich.*

conditions, or of changing their combinations,—no means of decomposing them practically, of adding a circumstance, or of withdrawing a circumstance, and observing the changes which follow. Yet, unless our knowledge is to be limited to the simple history of individual facts, all these operations must be performed by the mind. By a kind of intellectual chemistry, observations must be reduced to their elementary constituents, and again formed into new combinations, before they can give extent or comprehensiveness to our knowledge. It is here, therefore, that the aid of induction is so urgently called for, and that the neglect, or abuse of it, leads to consequences so baneful to the progress of science. "In by far the greater number of instances the appearances of nature are dependent upon a variety of different laws, all of which are often combined together in producing one single event. And whenever such a combination happens, although each law may take place with the most complete uniformity, it is likely that nothing but confusion will strike the mere observer. A collection of such results, therefore, would not advance us one step in the knowledge of nature, nor would it enable us to anticipate the issue of one new experiment. In cases of this description, before we can avail ourselves of our past experience, we must employ our reasoning powers in comparing a variety of instances together, in order to discover, by a sort of analysis or decomposition, the simple

laws which are concerned in the phenomena under consideration; after which, we may proceed safely in determining, *á priori,* what the result will be of any hypothetical combination of these, whether total or partial."*

It is easy to understand the untoward influence which the want of a severe method of induction has had upon those departments of knowledge which are almost exclusively fed by observations, and the obstacles which it has opposed to their progress. A comparison of the state of these sciences before and since the discovery of induction, with the state of the experimental sciences in the same periods, would place this matter in the clearest point of view. It is however time to draw these introductory observations to a conclusion, and we must, therefore, content ourselves with pointing out a few only of the more prejudicial consequences which have resulted from the neglect of method.

The first of these which may be specified, is the great waste of experience of which it has been the cause. For want of a proper use of induction to extract the knowledge to be derived from the particular facts, which time and occasion are constantly producing, years of experience are cast away, and man arrives at the end of his weary labours with a burdensome load, which memory is

* *Stewart's* Philosophy of the Human Mind.

now ill able to carry, instead of a few well assorted principles which would give strength rather than heap incumbrance. What is true of the life and experience of the individual, is true of the common life and experience of mankind. The world grows old in the accumulation of facts, but not of experience. Observations are piled upon observations without order or arrangement, and the mind, wearied and exhausted with the contemplation of the chaos, becomes indifferent by disappointment, and they are at last thrown aside or forgotten.

But the neglect of induction not only causes a waste of experience, and in this way embarrasses the progress of knowledge, it affords the opportunity of establishing positive errors, by giving a currency to false facts, (as they are called,) and to false doctrines. It is plain that if observations were analyzed and examined by a sifting process of the mind, the true and the false being compared with each other, the incongruity of the latter would soon betray their parentage. But, for want of some method to place facts in their natural correspondence with each other, there is no check upon the insincerity of the observer, and, consequently, the chance of reasoning upon false data is wonderfully increased.*

* Ma v'ha di più; siccomè contro 'l fatto, non si vuol replica, e di nessun fatto si vuole l' analisi; cosi l' impostura, la menzogna,

The same neglect of induction which exposes the mind to be misled by false data, exposes it also to false doctrines from true facts, by allowing them to be placed in false relations. Thus accidental are assumed to be constant conjunctions, precursive and consecutive events are erroneously connected together, and on these false relations, principles are established, from which flow errors in opinion and errors in practice, as well in science as in art.

But what may perhaps be regarded as not the least unhappy consequence which has sprung from the careless manner in which inductions have been conducted, is the neglect of the method itself. For, like an instrument which has been thrown aside, it has become stiff and rusty from disuse, and the art of applying it having ceased to be cultivated, it has lost all those improvements which occasion and convenience are ever suggesting. Enough, however, has already been said to show what importance is attached to this particular consequence, and enough also, it is hoped, to make obvious the necessity of directing more attention than has of late been given to those ameliorations of which the method may be susceptible. Nor can it be necessary to urge any further the expediency of its constant and rigorous application

la mala fede entrano impunemente, oltra l'ignoranzá, come principali elementi nella composizione de' fatti medici. *Rasori.* This censure is not more applicable to medicine than to the other sciences of observation.

in all branches of knowledge, and in all operations of art. For it is only by the general use of such an instrument that we can expect to be able to distinguish assertions from facts, to elicit the less striking relations which bind the different phenomena of nature, or to disentangle the thread which connects them all together. It is only by the universal use of such an instrument that knowledge can continue to procede in one even, unbroken, course, that art can become science and science generate art, and that the experience of every individual, and of all ages, can concentrate their combined force upon the one great object, the discovery of Truth,—the entire revelation of Nature.

CHAPTER I.

OF A NEW METHOD OF INDUCTION, PERFORMED BY TABULÆ INVENIENDI.

"Venit ei itaque in mentem posse aliquid simplicius proponi; quod in vulgus non editum, saltem tamen ad rei tam salutaris abortum arcendum satis fortasse esse possit. Atque diu et acriter, rem cogitanti, et perpendenti, *ante omnia visum est ei,* TABULAS INVENIENDI *sive legitimæ inquisitionis formulas,* hoc est, materiem particularium ad opus intellectûs ordinatam, in aliquibus subjectis proponi, tanquam ad exemplum, et *operis descriptionem ferè visibilem.*" *Cogitata et Visa.*

HAVING been much accustomed to have recourse to the common expedient of tables to assist me in various researches, it frequently occurred to me, that it might be possible by means of them to carry on a complete process of induction; but I found, that, making use of them in the ordinary way, any process of induction which could be performed by them, was little better than a bare enumeration of particulars; for they afforded no assistance either in discovering or in establishing the relations which existed between the circumstances of different facts. When, however, after repeated disappointments, I combined with the plan of tables the method of representing the circumstances or particulars of facts by signs, I soon perceived that the most accurate induction might be effected by

them; and with many facilities and advantages of which the usual medium of words does not allow.

The plan which I adopted for combining both these means together, and which I am now about to explain, consisted in placing a number of columns collaterally, corresponding to the number of instances or individual facts, which were to be examined ||, and a broader column † parallel to these, in which was written down vertically all the circumstances, or particulars of the different instances. Having appropriated a column to each instance, as the circumstances of the instances were written down in the broad column, signs were placed opposite to them, in the columns of the instances in which they were found. This process, *the translation of circumstances into signs*, (the principle of which is founded on the conjunction of circumstances,) was performed in the following manner. Each instance being denoted by a letter of the alphabet, taking A to represent the first, B, the second, and so forth; as the circumstances of the first instance were written down in the broad column,† or *column of circumstances*, (in the order in which they presented themselves,) the sign A was placed opposite to each, in the column of the first instance. In the same manner, in the second instance, for every circumstance which had already

|| † *Vide* Form I. *a*. Classification by Affirmative Circumstances.

been found in the first instance, A was placed in the column of the second instance. Such circumstances as had not been found in the first instance, were added to the column of circumstances, and the sign B was placed against them, in the column of the second instance. In like manner, in the third instance, the circumstances, the same as those of the two preceding instances, were denoted in the column of the third instance by their signs, A or B, respectively; and such circumstances of the third instance as were not found in either of the preceding, being first noted down in the column of circumstances, were denoted by a new sign, *viz.*, that of the instance C. And so on in all succeeding instances, the same circumstances recurring continued to be denoted by their original sign, and every new circumstance, being first inserted in the column of circumstances, by the sign of the instance which it first occurred.

The operation having been completed after this manner, every circumstance being represented by its sign, in its proper place, and in its proper instance, it was obvious that the relations of the signs to each other expressed the relations of the circumstances to each other, and that all the circumstances denoted by the same signs, were related to each other, more or less closely, for they had all coexisted in the particular instances, more or less frequently. It was, therefore, only necessary to ascertain the constancy of this relation, and the

position of the circumstances, antecedent or consecutive, in order to place them in their natural correspondence to each other, either as cause or effect, as effects of a common cause, or causes of a common effect. Pursuing this idea, I proceeded to collect together into another parallel column, ¶, all the signs from the columns of instances, arranging all the same signs together, each in their proper vertical line. On considering the nature of this last operation I soon perceived that I was carrying on a process of induction, differing, however, from the ordinary process in this,—that not only were the circumstances common to all the instances *brought in* under their common sign, but the subordinate or special circumstances were also *brought together* each under their signs.

As the affixing and assorting of the signs is determined by the *presence* of circumstances, this process has been called the *classification by affirmative circumstances.* The manner of performing it will be better understood by inspection of the table.

¶ Vide Form I. a.

Form I. a. CLASSIFICATION BY AFFIRMATIVE CIRCUMSTANCES.

*	¶ Classification of the Signs.								‖ Instances.																						
									I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	XV.	XVI.	XVII.	XVIII.	XIX.	XX.		
Circumstances.	A	B	C	D	E	F	G	H &c.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T		
†	A								A	A	A		A	A	A		A	A		A		A	A		A	A	A	A		
	A								A	A	A	A	A	A	A		A	A	A	A	A	A	A	A	A	A	A	A		
		B								B		B				B			B		B			B					
	A								A	A	A		A	A	A	A	A	A		A		A		A	A	A	A		
			C								C			C				C			C						C	C	
	A								A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A		
	A								A		A		A				A			A							A	A		
						F								F				F				F						F		
		B								B		B				B					B			B						
								H								H	H				H					H				
	A								A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A		
			C								C			C				C				C						C	C	
								K											K		K			K						
	A								A	A	A	A	A	A	A	A	A	A	A	A	A		A	A	A	A	A	A		
			C								C			C				C										C	C	
				D								D								D										
	A								A	A	A	A	A		A	A	A		A	A	A		A	A	A	A				
		B								B		B				B			B											
						F								F				F												
			C								C			C														C	C	
								H								H	H				H									
		B								B		B				B			B		B			B	B					
								M													M							M	M	
								H								H	H					H				H				
		B								B									B					B						
						F								F				F											F	
								T																					T	

* The subject of investigation may be inserted in this open space.

† By leaving some blank lines between the circumstances of the first instances, the circumstances of the succeeding instances may be placed in a more natural order.

On examining into the nature of the operation to which the signs, and, consequently, the circumstances, had been subjected by means of the preceding table, it was easy to be perceived, that besides the relation indicated between all the circumstances comprehended under the same sign, which has been already noticed, any relation between different signs or their corresponding circumstances, was also negatived; for each succeeding class of circumstances was excluded by those preceding it. Thus the class A of circumstances having been found present when the class B of circumstances was absent, according to the principle* laid down by Lord Bacon, the class A excludes the class B.† In the same manner, the classes A and B exclude the class C, and so on, the other classes successively. Therefore, as it is the effect of this process of classification to bring together under the same sign all those circumstances which have co-existed, so is it to exclude from

* Itaque naturæ facienda est prorsus solutio et separatio; non per ignem certe sed per mentem, tanquam per ignem divinum. Est itaque inductionis veræ opus primum (quatenus ad inveniendas formas) rejectio sive exclusio naturarum singularum, *quæ non inveniuntur in aliqua instantia, ubi natura data adest. Aut inveniuntur in aliqua instantia ubi natura data abest,* aut inveniuntur in aliqua instantia crescere cum natura data decrescat, aut decrescere cum natura data crescat.

† To use the language of Lord Bacon, A is the representative of instances *absentiæ in proximo* of the circumstances designated by B.

each other, and to distinguish by different signs, those which are independent of each other.

It can scarcely be necessary to observe, that, though it is the principle of this and of all classifications, that the succeeding signs and their circumstances are excluded by those preceding, the converse of this is not true. The circumstances of the class A are not excluded by any or by all of the other classes, although these may mutually exclude each other. Thus the characters of the genus may exclude the discriminative peculiarities of the species, of the varieties, and of individuals, but none of these last can exclude the genus, though they may exclude one another.

Although all the circumstances comprehended under the same sign, are in some degree related to each other, it cannot readily escape observation, that there must be among them some which are merely concomitant or accidental, (as for example all the special circumstances of the first instance must be concealed under the common sign A,) and therefore, until every such circumstance is rejected from each class, the induction is obviously imperfect. Now it is possible to proceed in two different ways, directly opposite to each other, in order to determine which are the circumstances in this predicament. The classification may be extended to a greater number of instances, by a method hereafter to be explained,* and observing those cir-

* Vide *infra*, Rectification of the Signs.

cumstances of each class which constantly recurring together, show a constancy of relation, the circumstances may be rejected, which do not recur together in any proportion to the number of instances. For a little consideration will show, that the instances which make up the complement of the whole number of instances, negative the circumstances which are thus defective in instances. And indeed this method of extending the classification to a greater number of instances, must very frequently be had recourse to, in order to make the classes strong enough to bear a process of further exclusion. And on some occasions, when the instances are very numerous, and the deficiency very considerable, it may be the shortest way of proceeding, and sufficiently correct for ordinary purposes. But the method which is more philosophical and more strictly correct, is to reject those circumstances which are deficient in their number of instances, on the evidence of individual instances, in which the greater number of the circumstances of the class are found, except those which are to be excluded *

As the affixing of the signs in this process is determined by the *absence* of circumstances, it has been called *the classification by negative circumstances.* The inspection of the table will easily suggest the manner of performing it.

* To repeat the language of the *Novum Organon*, on the evidence of *instantiæ absentiæ in proximo.*

Form II. CLASSIFICATION BY NEGATIVE CIRCUMSTANCES.

Class†.A		Circumstances.							
Instances.	Signs.	I.	II.	III.	IV.	V.	VI.	VII.	VIII
		*							
	a	A†	A	A	A	A	A	A	A
	b‖	*b*‖	A	A	A	*b*	A	A	A
	c	A	A	A	A	A	A	A	A
	d	*b*	A	A	A	*b*	A	A	A
	e	*b*	A	*e*	A	*b*	A	A	A
	f	A	A	A	A	A	A	A	A
	g	A	A	A	A	A	A	A	A
	h	*b*	A	*e*	A	*b*	A	A	*h*
	i	*b*	A	*e*	A	*b*	A	A	*h*
	j	A	A	A	A	A	A	A	A
	k	*b*	A	*e*	A	*b*	A	A	*h*
	l	A	*l*	A	A	A	A	A	A
	m	A	A	A	A	A	A	A	A
	n	A	*l*	A	A	A	A	A	A
	o	A	*l*	A	A	A	A	A	A
	p	A	A	A	A	A	A	A	A
	q	A	A	A	A	A	A	A	A
	r	*b*	A	V	A	*b*	A	A	*h*
	s	*b*	A	*e*	A	*b*	A	A	*h*
	t	A	*l*	A	A	A	A	A	A
¶ Classification of the Signs. — Class.		A				A		A	A	
Sub-Classes.	*b*	*b*					*b*			
	e				*e*					
	h									*h*
	l			*l*						
		b	*l*	*e*	A	*b*	A	A	*h*

* The circumstances of the class to be inserted in these blank spaces.

The circumstances of any class, (by which is of course meant any number of circumstances denoted by the same sign,) may be submitted to the operation of this table in the following manner. As the instances (which may be either the same from which the classes of the previous table had been formed, or new instances, containing few or more of the circumstances of the class under analysis), are examined one after another, for any circumstance of the class found in any instance, the sign of the class must be placed opposite that instance in the column of the circumstance,† and so on for all the succeeding instances. But when in an instance any circumstance belonging to a class is found defective, the sign of that instance,|| instead of the sign of the class, is to be placed in the column of the defective circumstance ; and this defective circumstance must retain the same sign in all the subsequent instances. In this way, a second classification, and a second process of exclusion is established; for, whenever a circumstance of a class is found deficient, the sign of the class being replaced by the sign of the instance in which it is first found deficient, it becomes excluded from the class on the evidence of the instance or instances in which it may be found wanting. After the circumstances have been compared in this way, in all the different instances, and

† || *Vide* Form II. Classification by Negative Circumstances.

the signs placed accordingly, the whole classification must be corrected at the foot of the table, by substituting for the signs of the circumstances, those signs which the circumstances have assumed in the particular instances; so that those circumstances only which retain the sign of the class, continue to belong to it. These, as it were, continue to affirm their relation to each other, whilst the others having received different signs, are removed from it, and, as it were, deny the relation, except under certain combinations of circumstances. It is therefore the nature of this operation to decompose the classes, formed by the first table, into subordinate classes, either partially or entirely; and this has accordingly led to the distinction of *classes* and *sub-classes* of circumstances.

It is however necessary to observe, that the principle of classification of this table is quite the reverse of that of the first. In the first table, the classes are determined by the *presence* of circumstances not found in any previous instance, whilst, in this table, the sub-classes are formed by the *absence* of circumstances which had been present in the previous instances. Therefore, though as in the first table, the classes do here also exclude each other, they do so in a contrary direction; the signs of the principal class being excluded by those of the sub-classes. Hence it is evident, that the method of exclusion which may

be performed by these tables, is double, and, as it were, bilateral, and that this principle of induction, admitting no contradictory instance, fulfils the condition which Lord Bacon requires; as far at least as the relations of circumstances can be determined by the constancy of their conjunctions.

There is a facility attendant upon the use of this table, which is worthy of being remarked. Besides completing the process of exclusion, it saves the trouble of selecting instances suited to the different circumstances; for, amongst instances which are defective in circumstances, it finds out those which are negative of any particular circumstance, and thus, adapting the instance to the circumstance, any particular knowledge of the circumstances of each individual instance is rendered unnecessary.

This table by a trifling modification becomes also susceptible of another advantage which deserves attention, for, as well as excluding circumstances from a class to which they do not constantly belong, it may be made to show the combination of circumstances, or the condition, under which they are either conjoined or separated from a class. Thus suppose that, besides having columns for only the circumstances of the class, other columns be appropriated or reserved for circumstances occurring collaterally,* (such circumstances being denoted

* Vide *infra*, Chap. iv. METHODUS CONTABULANDI.

by signs in the usual way, according to the instances in which they first appear,) it is plain that the signs will indicate the relations which may exist between the circumstances of a class and the collateral circumstances, and, in this way, it may be determined why a circumstance belongs occasionally to a class, and why, at other times, it is separated from it.

But though these tables afford the means of determining most accurately the relations of circumstances to each other, as far as can be ascertained by the constancy of their conjunctions, mediate or immediate, it is well known that a source of fallacy lies concealed under this, and therefore other criteria are necessary for determining these relations. The chief of these is the mutual modifications, or affections, which circumstances show, when they are in relation with each other. This is the object of the *tabula graduum* of Lord Bacon, and on it is founded another principle of exclusion.* For it might certainly be objected to the method of induction which has just been explained, that, though the signs do indeed express the absence and presence of circumstances, and the classifications perform a process of exclusion accordingly,

* Omnino sequitur ut non recipiatur aliqua natura pro vera forma, *nisi perpetuo decrescat quando natura ipsa decrescit, et similitur perpetuo augeatur quando natura ipsa augetur.*

the degrees, modes, and modifications of the circumstances, are left out of the account, and, hence, the evidence of the connexion between circumstances which co-exist, derived from their reciprocal variations, is neither made available to complete the exclusion, or to confirm the induction.

This very important part of every method of induction may, however, be fulfilled by a very simple expedient, which seems quite competent for every purpose that can be required of it. It consists in placing over the sign of any circumstance which presents itself under any modification, the sign proper to the instance in which this modification is found. In order to avoid a confusion of signs, the corresponding letter of the Greek alphabet, may be used instead of the Roman letter. Thus suppose a circumstance A recurs under a modification in the instance D, this will be expressed by A^{δ}. If, therefore, the modification of the circumstance A^{δ} is of sufficient importance to induce any change in any other circumstance with which it may be in relation, there will of course be found other circumstances, in the same instance, with signs of modifications, or there will be some new combination of the signs, or some signs absent or present, out of the usual order. And therefore, where circumstances under the same signs do not, by their signs, express such mutual affections or modifications, they must be excluded

from having any constancy of relation affirmed of each other.

And this seems a proper place to remind the reader, that the signs considered alone, and without reference to the circumstances, express relations, and not things. The circumstances which they signify must be found by referring to the column of circumstances, but the relations which the circumstances have to one another, are entirely expressed and shown by the signs. Now, by adding to the signs, either accents, prefixes, affixes, or suffixes, after the usage of grammarians, the signs might be made to express every possible relation which can exist between different things or circumstances, and, in short, might be converted into a perfect language of relations.

To recapitulate, having by the first process, *the classification by affirmative circumstances,* arranged and assorted the circumstances of all the instances, and formed them into classes, and having, by the second process of exclusion, or *classification by negative circumstances,* rejected from the classes all such circumstances as are not found constantly to belong to them, the circumstances which remain of each class, may be collected and arranged together. Not having been able, by the evidence of any instance, or individual fact, to separate these circumstances

from each other, or from their class, it is allowed to conclude that they are connected with each other by some natural relation, either as cause or effect of each other, as causes of a common effect, or effects of a common cause.* This relation is expressed here by the sign of the class. When the nature of this relation can be ascertained or explained, we are in possession of the meaning of the sign, and may substitute the one for the other. If that relation be referrable to any law, or general principle already known, our knowledge of it ceases to be empirical, but, if it continues isolated from any known law or principle, our knowledge continues empirical, and therefore the sign conveys as much meaning as any words expressive of the relation. Science is full of examples of the gradual conversion of empirical into what is called rational knowledge, but it is probable there may never be a nobler illustration than that which was afforded, when the laws of Kepler were merged by Newton in the general theory of gravitation.

* When we have carried the decomposition as far as we can, we are entitled to consider this simplest combination of indispensable conditions, as the physical cause of the event. When thus by comparing a number of cases, agreeing in some circumstances, but differing in others, and all attended with the same result, a philosopher connects as a general law of nature, the event with its physical cause, he is said to proceed by the method of induction.—*Stewart's Philosophy of the Human Mind.*

The classes thus reduced as it were to their last terms or elements, may, with their sub-classes, for sake of perspicuity, be arranged together in the following table, each under their respective signs, by which means every circumstance may be found in its proper place. And as this presents a complete and comprehensive view of the result of the whole process, by which all the circumstances or particulars stand assorted together, according to their natural relations and affinities, it has been called the form of *Synthesis*, being the proper preparation for that operation.

Form III. SYNTHESIS.

*Classes.	†	*Sub-Classes.					
		a	*b*	*c*	*d*	*e*	*f*, &c.
A.		¶					
B.		*a*	*b*	*c*	*d*	*e*	*f*, &c.
C.		*a*	*b*	*c*	*d*	*e*	*f*, &c.
D.		*a*	*b*	*c*	*d*	*e*	*f*, &c.
E.		*a*	*b*	*c*	*d*	*e*	*f*, &c.

* Vide *supra*, Form II.

† The circumstances of the *classes* to be inserted here, each following their respective signs.

¶ The circumstances of the *sub-classes* to be inserted here, each in their proper class, and under their proper signs.

The arrangement and distribution of the results of any analysis of particular facts, which is made by means of the preceding table, allows at once to be perceived what circumstances cannot be separated from each other, what are conjoined together only under certain combinations, and what cannot exist together. It may thus serve many very useful purposes, by showing at once all the bearings of the circumstances to each other; as well in facilitating the further progress of any investigation, as in directing, with more certainty and precision, the practical application of general principles to individual cases.

There can be no difficulty in understanding, that, although circumstances may, by this process of classification, be placed in different classes, yet very intimate relations may exist between them, their conjunction or separation only depending on the presence or absence of some other conditional circumstance. By referring to the classifications, or, if necessary, to the instances themselves, the circumstance or circumstances constituting the condition, may easily be discovered; and, by inspecting this table and observing their position and bearings, it will be possible to determine whether the condition be constant or occasional. In this manner, a circumstance which is isolated, may be restored to a class, or a particular class or group of circumstances, may, subject to such a condition, be placed in a class more general; and in the

same manner, also a sort of equation may be found between different classes, or between circumstances of different classes, allowing us, for instance, to say B + D = A, &c. &c.

This power of finding the conditions under which different circumstances are conjoined together, or by which they are united to or separated from different classes, gives, as it were, the faculty of creating hypothetical instances or individual cases, and of forming new combinations from the elements to which the facts have been reduced by the decomposing process of exclusion. In this way, it may be said, that a kind of visible analysis of the facts having been performed, much in the same way as the chemist in his laboratory reduces different substances to their elementary ingredients, new compounds may also be formed from them synthetically, according to the order of the affinities which have been found to exist among them.*

There is also another advantage derived from presenting the results of any analysis in the comprehensive manner of this table, for, the subordinate conclusions being placed in their proper relation to the principal, by comparing the abstract of one induction with that of another, they may be both put in correspondence, and thus the relations of one series of facts being connected with

* Sed naturam reverà persecet, et corporum virtutes et actus eorumque leges, in materia determinata, inveniat.

those of another, the whole chain of relations becomes lengthened and extended in every direction.

Lord Bacon informs us in different passages of his works, how fully he was aware of the difficulties which every one has experienced in practice, when he endeavours to apply general conclusions to particular cases; the removal of the specialties and individual peculiarities leaving such a chasm between the general principle and the particular case, and placing us, as it were, at such a distance from our object,* that frequently chance has as much influence as design in determining the success of the application. We learn therefore from the general outline of his plan that he did not consider the raising of general principles as the whole of the interpretation of nature; on the contrary, that he intended to give not only a descending as well as an ascending scale of principles, but also rules for reducing principles to prac-

* "Solent autem homines naturam tanquam ex prælta turri et à longe despicere, et circa generalia nimium occupari; quando si descendere placuerit, et ad particularia accedere, resque ipsas attentius et diligentius inspicere, magis vera et utilis fieret comprehensio." It is for this reason that he places all his hopes and confidence in what he calls intermediate principles, or axioms, which connect general conclusions with individual instances. "At media sunt axiomata illa *vera* et *solida* et *viva*, in quibus humanæ res et fortunæ sitæ sunt: et supra hæc quoque, tandem ipsa illa genalissima, talia scilicet, quæ non abstracta sint, sed per hæc media verè limitantur."

tice; by which, however, nothing could be meant but some intermediate steps or links which might connect the general conclusion with particular cases. Now it appears to me that some provision is made for these objects by this method of induction. For, by preserving all the subclasses, and specifical peculiarities, and by being able to discover their connexion and relation to the general classes on one side, and to the individual cases on the other, the conditional circumstances of each particular case may be added to the general principle, and thus ensure the success of its practical application.

Though the foregoing method of induction must be allowed to be correct in its principle, as well as in its operation, the conclusions deduced by it would be only limitedly or partially true, unless there existed some means of extending it to a greater number of instances than could be examined in a single table. If there was no way of placing the classifications of one table in correspondence with those of another, so as to generalize them, by comparing them in a greater number of instances, it would be an imperfect instrument, and rather fitted for a kind of pioneering preparation of materials for induction, by dressing them and putting them in order, than capable of performing that process.

This defect is, however, easily supplied by the

following method of combining together the classifications of different tables, and of assimilating the different signs to each other, in such a manner, that in a series of classifications the same sign may denote the same circumstance, and may continue to indicate the same relations between the different circumstances.

In order to effect this object it is necessary to refer back to Form I. *a*,* and to make a trifling alteration in the manner of performing the last operation of that table. If, instead of merely carrying the *signs* of the circumstances into the column of classification, the *number* of signs of each circumstance, or the *number* of times each circumstance has recurred in the different instances, be reckoned, and the numbers be placed in the column of classification, under its proper sign, of which it may be called the co-efficient, we shall be supplied with the means of extending an induction.†

* Vide p. 27.

† Vide Form I. *b*.

FORM I. *b.*

CLASSIFICATION BY AFFIRMATIVE CIRCUMSTANCES NUMERICALLY.

*	¶ Classification of the Signs.								Instances.																						
									I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	XV.	XVI.	XVII.	XVIII.	XIX.	XX.		
Circumstances.	A	B	C	D	E	F	G	H &c.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T		
†	15								A	A	A		A	A	A		A	A		A		A	A		A	A	A	A		
	19								A	A	A	A	A	A	A		A	A	A	A	A	A	A	A	A	A	A	A		
		6								B		B				B			B		B			B						
	15								A	A	A		A	A	A	A	A	A		A		A		A	A	A	A			
			6								C			C				C				C						C	C	
	20								A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A		
	7								A		A		A				A			A								A	A	
						4								F				F				F							F	
		5								B		B				B					B			B						
								4H								H	H				H					H				
	20								A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A		
			6								C			C				C				C						C	C	
								3K											K		K			K						
	20								A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A		
			6								C			C				C					C					C	C	
				2								D								D										
	15								A	A	A	A	A		A	A	A		A	A	A		A	A	A	A				
		4								B		B				B			B											
						2								F				F												
			4								C			C														C	C	
								2H								H					H									
								1T																					T	

* The subject of investigation may be inserted in this open space.

† By leaving some blank lines between the circumstances of the first instances, the circumstances of the succeeding instances may be placed in a more natural order.

As it may frequently be required to extend the induction to a greater number of instances than can be entered in any single table, it may be more convenient always to make the classification by affirmative circumstances, after the manner of the preceding table; but it must not be forgotten that the truth of the induction is determined by the similarity of the signs, and not by their enumeration. The co-efficients of the signs afford the means of connecting one classification with another, but the relations of the circumstances to each other depend entirely upon their being represented by the same sign.

Supposing, therefore, it is required to place the classifications of several tables, prepared like the preceding, in correspondence with each other, it is only necessary to transfer them to the following table, in which this operation is to be performed, and which, because it consists in correctly adjusting the signs to the circumstances, I have, for the sake of distinction, called the process of *Rectification.*

Form IV. RECTIFICATION OF THE SIGNS.

*	¶ Rectification of the Signs.								Classifications of Different Series of Instances.																	
									Series No. I.							Series No. II.						Series No. III.					
Circumstances.	A	B	C	D	E	F	G	H &c.	A	B	C	D	E	F &c		A	B	C	D	E	F &c.	A	B	C	D	E	F &c.
†		45							15									13					17				
	58								19							19						20					
					5																					5	
			21							6								7						8			
	47								15							15							17				
			20								6						6							8			
	50								20							12						18					
				29															13						16		
	25								7							9							11				
					8								4						2							2	
		24								5							9							10			
								H 13						H 4							L 2						H 7
	60									20						20						20					
				24							6						8							10			
								K 7						K 3								I 2					M 2
	60								20							20							20				
		30								12								8							10		
					20						6								3							11	
	55								15							20							20				
		20								4								7					9				
								K 8						F 2							K 5						F 1
		11									2						5								4		
								H 6						H 2								H 1					H 3

* The subject of investigation may be inserted in this blank space.

† By leaving blank lines between the circumstances of the first series, the circumstances of the subsequent series may be inserted in a more natural order.

The arrangement of this table is very similar to that of the first, the columns of the instances being occupied by the different series of classifications, and the column of classification by that of the column rectification. Having entered in the table, in the usual way, the circumstances with the signs and co-efficients by which they are denoted in each separate classification, on the same line opposite to them, the next step is to place the circumstances in correspondence with their proper class, by selecting from the different signs by which they may be denoted in the different classifications, the proper sign by which they ought to be represented; or the sign by which they would have been represented, had the circumstances been classified by one general, instead of several particular operations. Now, in order that the correspondence of all the signs may be preserved, that all the circumstances may stand relatively to each other, and to their signs, precisely as they do in the separate classifications, it is essentially necessary that the operation by which this is effected, should have a fair and equable influence on all the signs and on all the circumstances.

If the same circumstance continues to be denoted by the same sign in the different classifications, the operation is a simple one, and consists merely in placing under that sign, in the column of rectification, the sum of the co-efficients which stand before it in all the classifications. If, how-

ever, the same circumstance be denoted in the different classifications by different signs, that sign only is to be placed in the column of rectification, which carries the largest sum of co-efficients proportionate to the number of instances, as deduced from all the classifications: or in other words, the sign which has been most frequently repeated, and with it the sum of the co-efficients of all the signs by which the circumstance has been denoted. For it is self-evident, that if the same operation be performed equally on the signs of all the circumstances, the column of rectification (¶) will correctly represent the same correspondence of the signs and circumstances, and the same relations between different signs and different circumstances, which previously existed in each separate classification. The process being the same in all, it is obvious that the effect ought to be the same. Thus the circumstances standing in the same class before the process of rectification, will also be found together in the same class after that process, for, if they be naturally related to each other, the relation will be increased by being extended to a greater number of instances; but if, on the contrary, they stand together in one classification accidentally, and not in the others, then the process of rectification will place them in the proper classes to which they belong. So that in

¶ Vide Form III.

this way any false or casual relation will be destroyed, or expunged by this common operation, whilst any natural and well founded relation will be strengthened and made more conspicuous.

This method of extending an induction by rectification of the signs, may be carried to any degree; for the operation which has been applied to different series of classification may, also on the same principle, be repeated on different series of rectifications, and so on successively, until every instance is exhausted, so that at last there will only remain in the same classes, those circumstances which are constantly and universally related to each other. And in this manner, the process of *classification by affirmative circumstances* may be carried directly onward to such an extent, as to answer all the purposes of an *exclusion by negative circumstances*, and, when the instances are numerous, it may be conveniently substituted for it.

But, in order that this operation of rectification may produce true and equal results, it is absolutely necessary that it should not be applied to signs in different stages of classification. That is to say, that signs merely classified, and signs which have already undergone the process of rectification, cannot without an error be together submitted to the same operation; and, in the same way, that signs in the first stage of rectification, and signs in a more advanced stage, cannot together undergo equally the same operation, without false conse-

quences. For the signs most advanced in the inductive process will prevail over those which are less advanced, drawing them as it were into their more powerful vortex. As for example, should any circumstance be denoted in different classifications by the sings 20 A, 16 B, 13 C, 11 D, the principle of rectification would give 60 A as the proper sign. And suppose it is required to combine with this rectified sign 60 A, the sign in a classification of another series of instances, 25 B, it is evident that the operation of rectification being performed on these signs in different stages of classification, will give 85 A, but if it had been performed on signs in the same progress of classification, (20 A, 16 B, 13 C, 11 D, 25 B,) the true and proper sign would have been 85 B. It will therefore readily appear how important it must be, in order to prevent the signs from being displaced, and consequently to preserve circumstances in the classes to which they naturally belong, that the process of rectification should be performed on signs in the same stage of classification.

The process of rectification has been placed after that of exclusion or classification by negative circumstances, in order to afford at once a complete view of the *method of induction by classification*, but that may not always be the order in which they may be required to be made use of. It may frequently happen that the first process, the classification by affirmative circumstances, may not afford

classes sufficiently strong to bear the process of exclusion by negative circumstances, and in that case the classification must be continued by the process of rectification, until the classes are raised to a state which allows them to bear the process of exclusion. But in which ever order they may be used, the method is precisely the same.

In order to extend the classification by negative circumstances, or the second process of exclusion, to a greater number of instances than it is possible for a single table to hold, no further provision is required. It is only necessary to carry forward the corrected classification of the class, from table to table, until all the instances have been exhausted. If there still remain circumstances which cannot be removed from the class by the operation of this process, it may be concluded that they are constantly related to each other, and induction can reach no further.*

Such is the method of induction which the author has to propose, and for which he is sensible that he ought to solicit not less the indulgence than the attention of the reader; but, lest the unavoidable tediousness of the explanation may have made it difficult to comprehend it as a whole, it may be useful, in resuming succinctly,

* Tum vero post rejectionem et exclusionem debitis modis factam, secundo loco, tanquam in fundo, manebit, (abeuntibus in fumum opinionibus volatilibus) forma affirmativa, solida, et vera, et bene terminata.

to draw it into a narrower space, and state the processes of which it consists, the rules for performing these processes, and the precautions necessary for performing them correctly.

THE METHOD OF INDUCTION BY CLASSIFICATION CONSISTS OF THE FOLLOWING PROCESSES :—

I. *The translation of circumstances into signs,* which express not only the presence and absence of circumstances relatively to each other, but also their reciprocal modes and modifications; and which standing precisely in the position of the circumstances, indicate all the possible relations which can exist between them.*

II. *The classification of signs by affirmative circumstances* according to their conjunction in different instances or individual cases, by which those co-existing are classed together, and those not co-existing are excluded and separated from each other.†

III. The extension of this principle to any number of instances by the *rectification of the signs.*

IV. *Exclusion* of those circumstances from the classes formed by the previous processes which are not found constantly present in the classes; 1st, by the *classification by negative circumstances,*|| and 2dly, by *deficiency of mutual variations and modifications.*¶

* Vide p. 24, 25, 26. † pp. 27, 28.
|| p. 32. ¶ p. 36.

And I think I may venture to repeat that these processes together comprehend every possible manner by which events or circumstances can be considered in all their different aspects and affections, so as to decide by pure observation or experiment, how they stand related to each other, whether as cause or effect of each other, as common causes of a common effect, or common effects of a common cause, which is all that can be attained by any method of pure observation. "For," as Kepler long ago observed, "it is one of the commonest axioms of natural philosophy, that if two things always happen together, and in the same manner, and admit the same measure, either the one is the cause of the other, or both are the effect of a common cause."

RULES FOR PERFORMING THE DIFFERENT PROCESSES OF THE METHOD OF INDUCTION BY CLASSIFICATION.

I. *Translation of circumstances into signs.* For every circumstance found in any instance, place a sign opposite to it in the column of the instance. If the circumstance has been already found in any previous instance, the sign by which it was first denoted must be repeated, but if not so, the sign of the instance will be the sign of the circumstance. If any circumstance already found in some previous instance, presents itself in another instance with some variation or modification, the Greek letter corresponding to the Roman letter, the

sign of the instance, is to be placed over the sign of the circumstance, and this letter must continue the sign of the same modification in all succeeding instances.

II. *Classification by affirmative circumstances.* When all the circumstances have been translated into signs, according to the preceding rule, the signs of the circumstances are to be carried into the column of classification, each under their respective sign, so that the same signs may stand in the same vertical line;* or, the co-efficient of each sign is to placed in the column of classification instead of the sign.†

III. *Rectification of the signs.* The circumstances and the signs by which they are represented in the column of classification, are to be transferred to their appropriate columns in the table of rectification. If a circumstance is represented by the same sign in all the classifications, the sum of its co-efficients is to be placed under that sign in the column of rectification. But if a circumstance be denoted by different signs in the different classifications, it is necessary to find that sign whose co-efficient carries the greatest sum proportionate to the number of instances, and the sum of the co-efficients of all the signs must be placed under that sign in the column of rectification.‡

* Vide p. 26. † Vide p. 46.

‡ Vide p. 48, 49.

IV. *Exclusion.* First, by the classification by negative circumstances, the sign of the instance is to be substituted for the sign of a class wherever any circumstance of a class is found defective; and, second, any circumstance of a class which does not indicate modifications or affections reciprocally with the other circumstances of the class, is to be rejected from the class.

V. The products of the process of induction are to be at last transferred to the table of *Synthesis,* where every circumstance standing under its proper sign, whether of class or sub-class, shows the relations in which they all stand to each other.

PRECAUTIONS NECESSARY TO ENSURE THE CORRECT PERFORMANCE OF THE METHOD OF INDUCTION BY CLASSIFICATION.

I. It is of the first importance that the instances or particular cases submitted to examination should be as entire and complete in all their circumstances or particulars as it is possible to procure them. In whatever way an inductive process may be carried on, it must follow as a matter of course, that if the instances are mutilated or deficient in their circumstances, the conclusion must be relatively incorrect.* And, therefore, although we are

* Primo enim paranda est historia naturalis et experimentalis sufficiens et bona; quod fundamentum rei est; neque enim fingendum, aut excogitandum, sed *inveniendum quid natura faciat, aut ferat.*

enabled by this method to avail ourselves of fragments of instances, and to extract all the relations or evidence they are capable of affording, yet as it sets forth more to open day the false results which must ever attend any induction from imperfect instances, it demands more accurate histories of them.

II. It is also very important that the same expressions should, as nearly as possible, be used for the same circumstances, so that the signs may be expressions of things not of words only, or signs of signs. Otherwise, when the circumstances are translated into signs, by reason of a difference of expression, the same circumstance in reality may yet be denoted by different signs, which would obviously lead to a serious error. This part of the operation, the translation of circumstances into signs, corresponds very nearly to that which Lord Bacon calls the *excitatio notionum,* and if authority were necessary, we could not refer to any more decisive. But the history of every controversy offers sad but sufficient experience, that in every process of reasoning, the truth and certainty of the whole operation depends entirely upon the faithful and correct expressions of things, or the correct translation of circumstances into signs, so that neither may the same thing have different signs, nor different things the same sign.*

* Itaque si notiones ipsæ (id quod basis rei est) confusæ sint et temerè a rebus abstractæ, nihil in iis quæ superstruuntur est firmitudinis.

CHAPTER II.

The Method of Induction by Classification compared with the Method of the Novum Organon.

It cannot have escaped observation, that, in explaining this method of induction, no opportunity has been omitted of calling in the authority of Lord Bacon to sanction and to approve the different steps of the operation; and they who are more conversant with his particular precepts for carrying on the inductive process, or what he somewhere calls his *formula* for the interpretation of nature, must have already perceived how closely it has been sought to imitate, and how implicitly it has been endeavoured to obey them. But it seems also incumbent to show by a formal comparison with the standard of induction, which he has left as an example, that the requisite conditions for conducting the operation, are fully and sufficiently accomplished by the method of classification.*

I. It is only from the precepts which Lord Bacon has laid down for what he calls the discovery of

* For sake of convenient reference the reader may consult the luminous exposition of the philosophy of Lord Bacon in the "*Library of Useful Knowledge.*"

forms, that we are made acquainted with his particular manner of conducting a process of induction. Now it cannot be doubted, that not entertaining a very accurate notion of the limits which confine human knowledge, he set up a division of philosophy which experience has not authorised, and that not distinguishing, with sufficient precision, efficient from physical causes, he confidently anticipated, that science would be able to penetrate more deeply into the mysteries of nature than the severer philosophy of later times permits us to hope. He therefore certainly did comprehend under the term *form,* something more than what modern philosophers understood by the word *law* or *cause,* and hence separated the investigation of *forms,** from that which regards the common and ordinary course of nature.† Of the many discoveries, which since his time have given us an insight into the hidden nature of things, no one perhaps approaches so nearly to his conception of *form,*‡ as the theory of the latent heat of fluids. For although in the phœ-

* Leges fundamentales, et communes, quæ constituunt formas.

† Consuetudines naturæ particulares et speciales.

‡ Etenim forma alicujus naturæ talis est, ut eâ positâ natura data infallibiliter sequatur. Itaque adest perpetuò quando natura illa adest, atque eam universalitèr affirmat atque inest omni. Eadem forma talis est, ut eâ amota natura data infallibiliter fugiat. Itaque abest perpetuò quando natura illa abest, eamque perpetuò abnegat atque inest soli.

nomenon of the liquifying of bodies by heat, the sensible heat can only be regarded as a common physical cause, yet the latent heat which sustains its fluidity, is so intrinsically identified with the nature of fluids, that it might deserve some distinction from the manner of its cause, and be called in the language of the Novum Organon, its *form* or *quidipsum.** But it is sufficient for our purpose to know, that, besides this meaning of the word form, he did also attach to it another sense, the same as is generally understood by the laws of nature. Of this he has given clear and definite explanations in language of the purest philosophy ;† and as it therefore would be perfectly correct to say, that the laws of gravitation are the *form* of gravity, we are justified in considering his precepts for the discovery of forms as rules for investigating the laws of nature, the order of the succession of events, or, in other words, for the discovery of physical causes.

If then the language of Lord Bacon be translated

* Intelligatur hoc quod diximus de motu (nempè ut sit instar generis ad calorem) non quod calor generet motum, aut quod motus generet calorem (licet et hæc in aliquibus vera sint) sed quod ipsissimus calor, sive *quidipsum* caloris sit motus et nihil aliud.

† Licet enim in naturâ nihil verè existat præter *corpora individua, edentia actus puros individuos ex lege ;* in doctrinis tamen illa ipsa lex, ejusque inquisitio et inventio atque explicatio, pro fundamento est tam ad sciendum quam ad operandum. *Eam autem legem ejusque paragraphos formarum nomine intelligimus.*

into that of modern philosophy; if for *forms* and *formal causes* be substituted the *laws of nature*, the principles or rules which she constantly observes in her operations, and for *simple natures* or *abstract qualities*, the *simple and elementary forms of matter*, the constituent phenomena of events, the ultimate circumstances into which facts are capable of being resolved; if by *copulate forms* and *concrete natures* be understood *the laws which regulate the constitution and composition of bodies*, and by *latent process* or *latent structure, the proximate causes*, the series of minute actions which compose a phenomenon, or the minute parts and their adaptation to each other for the formation of any larger body; it will be found that all these different terms are only varied expressions of the same thing,—the constant order observable in the phenomena of nature. To say, therefore, that no event or circumstance can be the cause or effect of another unless they be constantly present in the same instance (*mediately* or *immediately*), and constantly absent, at the same time, from the same instance, and constantly increase and decrease mutually with each other, is faithfully to interpret the doctrine for the discovery of forms.*

And it seems to be not unworthy of being here remarked, that this axiom, which may be considered

* Est itaque inductionis veræ opus primum (quatenus ad inveniendas formas) *rejectio* sive *exclusiva* naturarum singularum, quæ non inveniuntur in aliquâ instantiâ, ubi natura data adest.

as the great DICTUM of the inductive logic, the severest scrutiny of modern philosophers has in no respect been able to alter or improve, and, that although Lord Bacon may not have entertained so accurate a notion concerning the relation of cause and effect as Barrow, Berkely, or Hume, yet, confining the knowledge of nature to ascertaining the constancy of the succession or conjunctions of events or circumstances, "ingenium rebus submittentem," in his principle and in his practice, he entirely anticipated their philosophy.

Lord Bacon having, as his meaning has been interpreted, fixed the above as the doctrine of causes, next proceeds to direct how it is to be put into practice for their investigation. For this purpose he points out, *first,* the necessity and importance of a full and sufficient history of all that is known concerning the subject of inquiry *(ministratio ad sensum); secondly,* the methodical arrangement of the materials of such a history, that the understanding may be better able to consider them, and the judgment to operate upon them more correctly *(ministratio ad memoriam);* and, these preparations being made, it is still necessary, *in the third place,* to guide and direct the understanding in raising axioms or drawing conclusions, which constitutes the particular act of induction *(ministratio ad rationem).*

Aut inveniuntur in aliquâ instantiâ ubi natura data abest, aut inveniuntur in aliquâ instantiâ crescere cum natura data decrescat; aut decrescere cum natura data crescat.

The methodical arrangement of the materials of any investigation, which he calls the presentation of instances to the understanding, *(comparentia instantiarum ad intellectum)*, consists of three tables. The first contains all the instances or particular facts in which the subject of inquiry is present, but under different forms or combinations,* and is therefore called *tabula essentiæ et præsentiæ.* The second contains those instances in which the circumstances which form the subject of inquiry, are absent. But, as it would be impossible to exhaust every negative instance, he means only such as are nearly related to the instances of the first table, resembling them in as many circumstances as possible, except those which constitute the subject of investigation.† Hence these instances are called *instantiæ absentiæ in proximo.* The third table contains those instances, in which the subject inquired into, presents itself in different degrees or modifications‡ and which for this reason he calls *tabula*

* Quæ in natura eadem conveniunt per materias licet dissimillimas.

† Itaque subjungenda sunt negativa affirmativis et privationes inspiciendæ tantum, in illis subjectis, *quæ sunt maxime cognata illis alteris,* in quibus natura data inest et comparest.

‡ Tertio facienda est comparentia ad intellectum instantiarum, in quibus natura, de qua fit inquisitio, inest secundum magis et minus; sive facta comparatione incrementi et decrementi in eodem subjecto, sive facta comparatione ad invicem in subjectis diversis.

graduum. These tables being completed and well furnished with their appropriate instances, we may next proceed to perform the induction, which is the rejection or exclusion of circumstances according to the doctrine above laid down.

It is plain that the instances of the first table can afford only very imperfect knowledge of the cause or nature of the subject under investigation, because it can only be known as it exists in its different particular combinations with other circumstances, as presented in each individual instance. It may be surmised or conjectured, from observing some circumstance more frequently than the others in the combinations, that it is the probable cause, but all certain information concerning it must be limited to particular conclusions.* It is therefore necessary to compare with these instances, the instances of the second table, *seriatim.* Now it follows, that all the circumstances found equally in the instances of the first table and in the instances of the second table, and therefore not fulfilling the first condition of cause and effect, viz. being perpetually present in the same instances, and absent at the same time from the same instances, can have

* Nullum enim per eas constituitur axioma, sed tantum notio simplex cum historia ordinata; certò verificata per ministrationem primam atque ita repræsentata per secundam, ut tanquam in potestate nostra sit. *Impetus Philosophici.*

no connexion with the subject of the inquiry.* In like manner, in the instances of the third table, where the subject of the inquiry presents itself in different degrees or modifications, all those circumstances which do not show corresponding changes, are to be rejected or excluded, because they do not fulfil the second condition of cause and effect, viz., perpetually increasing and decreasing together.†— Setting aside the circumstances which do not belong to the subject of inquiry by a comparison of these different kinds of instances, constitutes the process of exclusion.

After all the circumstances which fall under the two preceding predicaments have been removed, it is permitted by Lord Bacon to affirm the remaining circumstances of each other, (*Vindemiatio prima,*) this, however, not universally, but only under the conditions in which they are combined; and this he calls limiting the affirmative conclusion by differences.

To have simply stated the doctrine and explained the precepts of the *Novum Organon* would seem to be all that is necessary to lead the reader to the conclusion, that the method of induction by classi-

* Quia forma, ut dictum est, non minus abesse debet ubi natura data abest; quam adesse ubi adest.

† Omnino sequitur ut non recipiatur aliqua natura pro vera formâ nisi perpetùo decrescat, quando natura ipsa decescit et similitèr perpetuo augeatur quando natura ipsa augetur.

fication is founded precisely on the same principle, and works by the same rule as the method of Lord Bacon, and that they only differ in some modifications of the means of performing the operation.

If the first table of the *Novum Organon* be compared with the table of *classification by affirmitive circumstances,* it is evident, that the former is a mere historical collection of instances, containing the subject of inquiry in different forms or combinations, but no progress whatever has been made towards induction; whilst the latter, by resolving the particular combinations of the circumstances of all the different instances into separate classes of circumstances, according to their relative coexistence, narrows the field of investigation to the class containing the subject or particular circumstance of inquiry, excluding all the other classes as has been already explained. So that the first table of classification is not only a *tabula essentiæ et præsentiæ,* but as soon as the signs have been collected into classes, becomes also a table of exclusion.

The *classification by negative circumstances* is an exact copy of the operation performed by the second table of Lord Bacon, by which, circumstances though classed together, are rejected from the inquiry by individual negative instances. There is this difference, however, that, by the operation of this table, the particular instances are se-

lected and applied to the circumstances of the class without any previous acquaintance with them, and without the necessity of arranging them, or of searching for them.

In the same manner, *the signs of the modifications of circumstances*, imitate precisely the instances of the *tabula graduum*, and serve the same purpose, preparing for the rejection of circumstances which do not express reciprocal modifications.

It appears, therefore, that the process of exclusion which Lord Bacon reserves for his fourth table, has been already anticipated, partly by the classification by affirmative circumstances, and partly by the classification by negative circumstances; so that these two tables perform the operations of all the tables of Lord Bacon, and complete the process of induction.

The arrangement of the results in the last table (Form III. *or Synthesis*) may also be compared to the affirmative conclusion of the *vindemiatio;* for there, the circumstances remaining after the process of rejection are brought together, and affirmed of each other; subject, however, to the condition in which they are found, and by which the conclusion is limited.

But, not to draw out this comparison to an unnecessary length, I think it is perfectly correct to say, that, the tables of classification being in-

struments strictly adapted for discovering and determining the constancy of the conjunction of circumstances or events, the method of induction by classification is nothing more than a reduction of the DICTUM of the Novum Organon to practical rules, which, by the aid of signs and tables, may be worked almost mechanically.

II. The comprehensive view which Lord Bacon took of philosophy, did not terminate here; for, besides the raising of axioms or general principles from particular instances, it was his intention to have laid down rules to direct not only the application of general principles to particular cases,* but also for deducing new cases from general principles. It is deeply to be regretted that he never finished this part of his work, and that the world should have been deprived of the expedients which might have suggested themselves to his penetrating genius for the furtherance of so important a part of philosophy as that which, as he expresses it, renders science active. It cannot, however, fail to be interesting to know even his distant con-

* Indicia de interpretatione naturæ complectantur partes *in genere* duas; *primam* de educendis et excitandis axiomatibus ab experimentis; *secundam* de deducendis et derivandis experimentis novis ab axiomatibus. Neque enim in plano via sita est, sed ascendendo et descendendo; ascendendo primo ad axiomata, descendendo ad opera.

templations of such a subject, and to collect his suggestions as they have descended to us, scattered here and there in his works.

How accurate were the notions which he entertained concerning this subject, may be learned from some prefatory observations which he has delivered. Thus he reminds us, that in the investigations which are carried on by the inductive formula, a constant intercourse may be kept up between the contemplative and active part, or between the corresponding steps of the ascending and descending scale of axioms, by what he calls an open and convenient *cross-path*,—"manifesto et constanti tramite." And, that men should never forget, that individual cases, which must ever be the subject of practical applications, are of course at the bottom of the scale, and that therefore a descending scale is necessary, by which they may come down gradually from their lofty generalities, and make themselves acquainted with particular combinations.* Nor, he adds, is it possible to descend to individual cases by single axioms or principles, for the individual combinations can seldom be so simple but that different principles have also an influence upon them. This, therefore, leads to the necessity of considering the union or composition of axioms with one another in order to

* Omnis enim operatio in individuis versatur, quæ infimo loco sunt. Itaque à generalibus per gradus ad ea descendendum est.

insure a correct and successful practical application of general principles.*

From these observations may be deduced the three different parts of which he intended his *active doctrine,* (as he terms it,) to consist. The first of these was to have laid down a distinct and proper manner of inquiry, when it is no longer a cause, or a principle which is to be discovered, but their practical application to one particular case, or the practical execution of one particular operation. The second was to have shown a manner of preparing general practical tables, by which a method of applying general principles or of effecting every kind of operation might be more readily and easily supplied. The third would have taught a method, though imperfect yet very useful, by which we might proceed from one individual case to another, without raising axioms or drawing general conclusions. For, he observes, as from one principle to another, so from one individual case to another, a kind of cross-way may be opened, though neither so safe or certain yet very deserving of attention—" instabilis et lubrica sed non silentio prætermittenda." From these observations and from this explanation of his intentions, may be collected, that, contrary to the method of induction, by which we proceed from particulars

* Neque rursus fieri potest, ut per axiomata simplicia ad ea perveniatur; omne enim opus atque ejus ratio *ex coitione* axiomatum diversarum instituitur et designatur.

to generals, which has only one correct road, the method of practice has two. The first of these is by a gradual descent from generalities to particulars, in which the more general principle as it proceeds downwards enlarges, its base, by the gradual addition of other axioms, or principles less general, but which have an influence upon the particular case. And such ought to be the object of a philosophical *synthesis,* but how very different from the present use of this process we may easily learn by inspecting any single practical illustration of it, where a few general conclusions are at once applied to the most particular cases. The other is the method of lateral *transduction* by the *cross-way,* either from one individual case to another, or from an axiom or principle in the ascending scale to its corresponding one in the descending scale. This last is the *experientia literata* of which Lord Bacon has left us a masterly sketch; and although it may not advance science or establish art on the broad basis of induction, yet as it seems to be the means by which man in the earlier stage of society ministers to his wants and converts the gradual accessions of knowledge more speedily to his use;—and being the only method of every art which has not been enlightened by science, it seems to me to deserve more careful cultivation than has, heretofore, been bestowed upon it.

Were I not afraid of seeming to attribute too

much to the induction by classification, I should be disposed to say, that its advantages are not solely confined to the method of *analysis*, but that, by preserving all the subordinate classes which result from that operation, it promises to be useful in the method of *synthesis*. For, by allowing them to be added to the principal class, it forms a gradual and continuously descending scale which connects the general conclusion with each individual case. And, in the same manner, all the individual and specifical peculiarities being distinguished and brought forward, may serve as *sign-posts*, (continuing Lord Bacon's comparison), to direct the observer to the different *cross-ways* which lead between the corresponding stages of the two great roads, and thus help to convert the *experientia literata* into a more correct guide.

This would have been the fit place to have considered whether the rules of the Aristotelian logic might have afforded any useful assistance for directing the application of general principles to particular cases, that being more properly its province, but I prefer reserving my observations on that subject until I have considered more particularly the general nature of classification. In the mean time, however, it may be remarked, that Lord Bacon seems not to have entertained such an opinion, having very accurately perceived the reason why the syllogism can never be applied to

any subjects but such as are of the nature of conventional science, if it be allowed to use such an expression.*

* Si concedatur, principia scientiarum ex inductione qua utuntur vel sensu et experientiâ, rectè posse constitui, certissimum est tamen, axiomata inferiora ab iis per syllogisimum non posse (*in rebus naturalibus quæ participant ex materia*) rectè et tutò deduci. In syllogisimo enim fit reductio propositionum ad principia per propósitiones medias. Hæc autem sive inveniendi sive probandi forma in scientiis popularibus (veluti ethicis, politicis, legibus, et hujus modi) locum habet. Imo et in theologicis, quando quidèm Deo pro bonitate sua placuerit captui humano se accomodare. At in physicis, ubi *natura opere*, non *adversarius argumento*, constringendus est, elabitur planè veritas ex manibus, propter longè majorem naturalium operationum, quam verborum, subtilitatem.

CHAPTER III.

Of certain Advantages peculiar to the Method of Induction by Classification.

"Neque tamen illis nihil adde posse affirmamus; sed contra, nos qui mentem respicimus, non tantum in facultate propria, sed quatenus copulatur cum rebus, artem inveniendi cum inventis adolescere posse statuere debemus."

If the judgment of others should correspond with my own conviction, I shall not have been unsatisfactorily occupied in the preceding chapters, in endeavouring to explain the method of induction by classification. I trust indeed that I have succeeded in showing, that it is a safe and correct way, of carrying on that process, and, that although performed by a different operation, it is virtually the same, and of course founded on the same principles, as the method of Lord Bacon. But I am not disposed to think that this would have afforded a sufficient reason for trespassing on public attention, could it not also be made appear that it offers certain advantages which the ordinary method does not possess.

I. There are many branches of knowledge, ministering equally to the happiness and well-being

of mankind to which the organ of induction has never yet been applied; every attempt to effect this desirable object by the ordinary method having ended in disappointment. Among these may be numbered civil polity, political œconomy, statistics, medicine, meteorology, and many other departments of science. There is no difficulty in understanding why the benefits of the inductive logic have not been extended to them. It is well known to arise from the great number of particular circumstances which enter into the instances, or individual facts, which belong to these sciences, and the great diversity of their combinations. It is impossible for the mind, unassisted by some help or expedient, to comprehend all the circumstances,—to estimate their relative influence, and to consider the changes induced by their different combinations. A few circumstances, often selected, more by prejudice, caprice, or chance, than by judgement, entirely absorb the attention, whilst others, frequently the most important, are left totally disregarded. The necessary consequences of this faulty reasoning are partial inductions or false classifications, unfounded theories and unsuccessful practical applications. Now, although I cannot allow myself to believe that the method of classification removes the source of all these errors, I am confident that it affords very considerable assistance towards it, and that placing many subjects within the grasp of induction which

have been heretofore excluded, it leads to the establishment of more correct general conclusions.*

There is another advantage which follows from the power of being able, by this method of induction, to comprehend and consider every circumstance or particular, to which allusion has been already made in a former part of this work. I mean that, whilst the more general conclusions must be correctly deduced, those which are less general are not neglected, and even the circumstances the most specific are all distinguished; and hence by this means an uninterrupted chain of circumstances connects the general conclusion with each of the individual instances from which it has been deduced. We are thus enabled to keep up a more intimate acquaintance with individual facts, and, by combining with the general conclusion those which are subordinate or more specific, we ensure a greater degree of certainty when we apply a general principle to a practical purpose. In this way, it may not be too much to say, that the method of classification unites to the ascending scale, or the rising from individual facts to general conclusions, a kind of descending scale, which leads from general principles to individual facts, and thus serves in some degree the object of what Lord

* Interim particularium multitudinem nemo reformidet, quin potius hoc ipsum ad spem revocet. Sunt enim artium et naturæ particularia phenomena, manipuli instar ad ingenii commenta, postque ab evidentia rerum disjuncta et abstracta fuerint.

Bacon intended by his reduction to practice, (*deductio ad praxin,*) or a method of making the discovery of general principles active, and useful to mankind.

To this may be added another advantage which also results from the power of considering every circumstance and of embracing all the relations which may exist between the circumstances. It is, that there is no experience lost or cast away; for many circumstances, and many relations of these circumstances, though not comprehended in the general conclusion, are yet brought under the attention, and may be made available in other inquiries. Thus the relations of different circumstances observed incidentally in one investigation may be made to abbreviate the labour of another, and may suggest hints for directing the pursuit after those which still remain concealed. In this way, the method of classification may be fruitful in eliciting those striking and luminous facts which Lord Bacon calls *prerogative instances.* And this gives me also the occasion of repeating, what has before been said of experiment, that it is the power of creating *prerogative instances;* and therefore I may add, that this method of analysis, by drawing out such instances, affords, in some degree, the means of endowing observations with the privilege of experiment.

It is also an advantage peculiar to this method of induction that, besides the power of considering

every circumstance, it may also embrace any number of instances. There are many circumstances which are intimately connected with each other, whose relations do not appear in a few instances, but when followed through a great number, accumulate to a degree which it is impossible to overlook. The individual facts or instances to which I am alluding, seem to resemble each other so closely, that when the induction is confined to a small number, the affections of their different circumstances towards each other cannot be discovered. But that difference which is trifling and when confined to a few instances, escapes observation, accumulating and enlarging with the number, attracts the attention and invites investigation. It is however most difficult—indeed almost impossible, to extend the common method of induction to a number of instances sufficient to make such minute relations apparent, and it is therefore only in such things as are mensurable, admitting of the application of the calculus, in which they can be traced. To proceed through such a number of instances by the ordinary method of exclusion, would exhaust the patience and exceed the power of attention of the most indefatigable observer. But the method of classification may be extended to any number of instances, without requiring any extraordinary intellectual effort, and the process being almost mechanical, may be safely confided to any capacity. It may therefore be permitted to say, that subjects beyond

the grasp of the ordinary method, either on account of the number of their circumstances or the number of their instances, are yet within the reach of the method of classification.

II. The next peculiarity of the method of classification which it is proper to notice, is that which arises from the operation being performed by determinate rules, the facility of the process being thereby very much increased, and the chances of error very much diminished. Every one knows how easy the most difficult operation becomes when reduced to a rule which allows it to be repeated. Arithmetic affords many examples of this kind. Processes which have required the most consummate skill in the contrivance, when reduced to a rule by which they may be frequently repeated, become so easy as to be performed almost mechanically and without any effort of the attention. Such a rule becomes an instrument which, when placed under the direction of even the most common capacity, enables it to perform, with the greatest facility, an operation which may have cost the greatest pains and labour to the inventor, and thus renders the success of the operation independent of the qualities of the mind.*

When the method of conducting any investigation is left to the option of the inquirer, errors are

* Nostra vero inveniendi scientias ea est ratio, ut non multum ingeniorum acumini et robori relinquatur, sed quæ ingenia et intellectus ferè exæquat.

apt to creep into the results from two different sources. The method not having been examined and reduced to fixed rules of procedure may contain within itself the cause of erroneous results. But the other is a more fruitful source of error; for, where no fixed rule has been laid down, the mind in its operations is constantly exposed to the bias and prejudice of the feelings; and the understanding, instead of proceeding directly forward, is frequently drawn aside to false conclusions. It is therefore an advantage which belongs peculiarly to the method of induction by classification, to guard the understanding from the influence of those causes of error which Lord Bacon distinguishes by the name of *idola;* for, by enforcing a regular method of procedure, it bestows all the correctness and the facility which the repetition of any operation is capable of ensuring.

To this head may also be referred the advantage which belongs peculiarly to the use of signs instead of words, by which all those errors of induction depending upon the inaccurate use of language, are completely obviated. Words can seldom be restricted to one distinct sense, or made to convey only one meaning; but the signs can have no other meaning than the circumstances which they represent. If therefore the translation of the circumstances into signs has been made correctly, the operation which is performed by the signs is no longer subject to the errors which arise from un-

defined or double meanings. And mere signs, being pure abstract forms like figures, can neither feel the influence of passion or prejudice, and their combinations being made by definite rules, cannot be altered by the will or the feelings.*

III. The advantages of the method of classification which have just been alluded to, belong more strictly to the nature of the operation considered in itself; those which I have now to mention, relate to the influence which it is likely to have upon the minds of those who may make use of it, and the mental habits which it is likely to induce.

It being the nature of the method of classification, to direct the attention to every circumstance of an instance, such as are defective of circumstances, are easily observed, and those which are incorrect, more certainly detected. In this way it may be said to ensure more perfect materials for the intellect to work upon, and to protect it equally from such as are false or imperfect. But leading thus to a more accurate knowledge of the qualities of particular instances, it ensures habits of close and accurate observation. As the eye gains correctness and precision from the use of optical instruments, it may not be too much to hope that the "mind's eye" may increase its power and field of vision by a mental instrument, and that thus

* Atque ut instrumenta manûs motum aut cient aut regunt; ita et instrumenta mentis intellectui aut suggerunt aut cavent.

that important talent for the interpretation of nature, the power of observing with truth and fidelity, may be promoted by its habitual use.

After the habit of clear and correct observation, which the use of this method of analysis tends to nourish and indeed to insist upon, I may mention another beneficial consequence likely to arise from it, equally necessary and important for forming correct judgments and well founded opinions,—I mean the habits of method, of clear and perspicuous arrangement, which must necessarily be formed by the use of this instrument of method. On this subject I cannot do better than introduce the philosophical observations of M. Cuvier, who long exercised in the habits of method, has made it subservient to such splendid results in the natural history of the animal kingdom.

" Cette habitude que l'on prend nécessairement en étudiant l'histoire naturelle, de classer dans son esprit un très grand nombre d' ideés, est l'un des avantages de cette science dont on a le moins parlé, et qui deviendra peut-être le principal, lorsqu' elle aura été généralement introduite dans l'éducation commune ; on s'exerce par-là dans cette partie de la logique qui se nomme la méthode, à peu près comme on s'exerce par l'étude de la géométrie dans celle qui se nomme le syllogisme, par la raison que l'histoire naturelle est la science qui exige les méthodes les plus précises, comme la géometrie celle

qui demande les raisonnemens les plus rigoureux. Or, cet art de la méthode, une fois qu'on le possède bien, s'applique avec un avantage infini aux études les plus étrangères à l'histoire naturelle. Toute discussion qui suppose un classement des faits, toute recherche qui exige une distribution des matières, se fait d'après les mêmes lois ; et tel jeune homme qui n'avait cru faire de cette science qu'un objet d'amusement, est surpris lui-même, à l'essai, de la facilité qu'elle lui à procurée pour débrouiller tous les genres d'affaires."

I will close this enumeration of the advantages which are proper to *the method of induction by classification,* by drawing the attention to one which to many may seem to be rather remote, but which to me appears to be highly deserving of consideration. I allude to the mental operation, when induction is carried on unconsciously and intuitively, being exactly represented by the process of classification :—For if, as I think, there is reason to believe that the understanding when acting, "*spontè et memoritèr,*" does observe this method, or one very similar to it, it follows that the tabular analysis as it proceeds, sets constantly before the mind a reflected picture of its own operation, in a permanent and tangible form, which, complete in all its details, may be reviewed and referred to as occasion demands. This cannot be said of the most correct and vivid conception, or of the most

cool and deliberate judgment; for so evanescent are the operations of the mind, that they elude the powers of the most retentive memory, and, defying every effort to retrace them, preclude the possibility of recovering any false step of the inductive process.

CHAPTER IV.

METHODUS CONTABULANDI:

OR, MODIFICATIONS OF THE TABLES OF ANALYSIS TO SUIT DIFFERENT SUBJECTS OF INVESTIGATION.

"Atque insuper, cum tantus sit particularium numerus, et quasi exercitus, isque ita sparsus et diffusus, ut intellectus disgreget et confundat, de velitationibus et levibus motibus, et transcursibus intellectûs, non bene sperandum est; *nisi fiat instructio et coordinatio per tabulas inveniendi idoneas, et bene dispositas, et tanquam vivas;* eorum quæ pertinent ad subjectum in quo versatur inquisitio, atque ad harum tabularum auxilia præparata et digesta mens applicetur.

Novum Organum, Aphorismus, C. II.

They who have taken the pains to make themselves acquainted with the method of induction by classification, will find it a matter of little difficulty to adapt its principle to the subjects of their investigations. The spirit of inquiry will readily suggest such alterations of the tables of analysis as may be necessary to fit the instrument to its object. To facilitate, however, as much as possible, the use of this method, I have thought it proper to preface its application to particular subjects, with some general modifications of the tables suited to the different forms in which the materials may be presented. But lest the reader should be daunted by the formidable array of so many tables, I beg to encourage him by reminding him, that the whole process of induction

seldom requires more than two tables, viz., one form of *the classification by affirmative circumstances*, and another form of *the classification by negative circumstances;* and, that a third, *the rectification of signs*, is only requisite when it is necessary to extend the induction to a great number of instances.

The first table is the common form of classification by affirmative circumstances, and the four which follow it, (Nos. II, III, IV, V,) are its different modifications. The nature of the operation performed by this table I have already explained.* The form is simple in its construction, and general in its application, but more fitted for digesting and arranging materials in their rougher state, than for perfecting the work of induction. It is sufficient that the instances have some common points of resemblance. Submitted to the operation of this table, the circumstances which they contain, will be assorted together according to their natural relations; the circumstances being divided into different classes, the process of exclusion will have been commenced, and the general connexion of the circumstances of the same class being made to appear, the field of inquiry will become narrowed, and the work of induction half performed. But, as the subject matter of inquiry is presented in different forms, so this table requires corresponding alterations in

* Vide, Chap. I., page 26.

order to be able to receive them. Thus No. I. is best suited for investigations consisting of numerous instances of few circumstances. With the view of saving room, the names of the instances are numbered instead of being written; should, however, any inconvenience attend this arrangement, the spaces of each instance may easily be left wide enough to receive the names. The open space * in the heading is left for the insertion of the subject of inquiry. In writing down the circumstances of the first instance, it is more convenient to leave some lines blank, which allows the new circumstances of the following instances to stand in their proper order of conjunction, whether of time or otherwise.

No I.—*General Form for the Analysis of any subject consisting of numerous instances of few circumstances.*

*	¶ Classification of the Signs.								‖ Signs of the circumstances as they present themselves in each Instance.																			
									I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	XV.	XVI.	XVII.	XVIII.	XIX.	XX.
Circumstances.	A	B	C	D	E	F	G	H &c.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
†																												

* The subject of investigation to be inserted in this open space.

† Blank lines to be left between the circumstances of the first instances, in order to allow the new circumstances of other instances to be inserted in their proper order of time.

The second table contains two forms, and is suited to subjects where the instances are of the same description as those of the preceding table, not containing many circumstances, but where the instances themselves are not very numerous. The alteration is merely one in which the saving of space has been consulted.

No. II.—*Forms for the Analysis of any subject where the Instances are few, and the circumstances not numerous.*

*	Classification of the Signs.					Instances.				Instances.				Classification of the Signs.					*
The circumstances as presented in all the different instances.	A	B	C	D	E &c.	I. A	II. B	III. C	IV. D &c.	I. A	II. B	III. C	IV. D &c.	A	B	C	D	E &c	The circumstances as presented in all the different instances.

The third table introduces a more considerable change in the form, but without any change in the principle by which it operates. It has been resorted to solely for the purpose of saving room, and for preserving the table in a more compact form. It consists of a double series of signs, and of course of a double classification, but as the second series of signs are merely the Italic in correspondence with their respective Roman letters,

the second classification is a continuation of the first, precisely the same as if continued in the same direction downwards. This table adapts itself conveniently to subjects of inquiry, where the instances consist of numerous circumstances, but the arrangement of the double signs affords many other facilities for investigating a subject by comparison, by contrast, and by allowing the order of time to be more correctly observed in the insertion of circumstances.

No III.—*Form for the Analysis of any subject, when the Instances consist of numerous circumstances.*

*	Classification of the Signs.						Instances.					Classification of the Signs.						*
All the circumstances which present themselves in their different Instances.	A	B	C	D	E	F &c.	I. A.a	II. B.b	III. C.c	IV. D.d	V. &c. E.e	a	b	c	d	e	f &c.	Circumstances continued.

The fourth table is another form to suit instances of the same description as the preceding, but where they are not very numerous.

No. IV.—*Form for the Analysis of any Subject where the Instances are few, but where they consist of numerous circumstances.*

*	Classification of the Signs.					Instances.				Instances.				Classification of the Signs.					*
The circumstances as they present themselves in different instances.	A	B	C	D	E &c.	I. A	II. B	III. C	IV. D &c.	V. A	VI. B	VII. C	VIII. D &c.	A	B	C	D	E &c.	Circumstances continued.

The fifth table is a form which combines the method of classification with a common register. This is done either by inserting the signs between the written lines, and by afterwards classifying the circumstances by the signs in the usual way; or by leaving space large enough to write, in words, those circumstances which though indifferent, or of little importance in the investigation, are yet important to be recorded, and by denoting the other circumstances by signs for classification in the ordinary method of proceeding.

No. V.—*Form for combining the method of classification by affirmative circumstances with a common register.*

* Circumstances as they present themselves in the different instances.	Classification of the Signs.						Instances.						
	A	B	C	D	E	F &c.	I. A	II. B	III. C	IV. D	V. E	VI. F	VII. &c. G

Having by either of the preceding tables, which ever may best suit the nature of the instances, assorted the different circumstances of which they consist into classes, we are at liberty to pursue our induction directly onwards, by continuing the *process of classification affirmatively* through a greater number of instances; or we may prefer bringing the inquiry at once to a conclusion, by subjecting the leading or principal class to the *process of classification by negative circumstances.* In the former case we transfer the classified signs to a table of *rectification.* In the latter case we transfer the

class of circumstances, which we wish to examine, to the sixth table, or to some of its modifications.

In this latter table we entirely change the order of investigation, for, instead of making the instances serve for establishing classes as in the first process, they are the means by which we decompose the classes which we have already formed; and the signs instead of denoting certain circumstances being present, do in this second process denote the absence of certain circumstances. And also, as by the first process, the preceding exclude the succeeding classes, so by the second process, the succeeding exclude the preceding classes.

The subject of investigation may be already in such a state as to allow of the circumstances being at once submitted to the last process of exclusion, or classification by negative circumstances, having been already, either by supposition or observation, connected together so as to form a class of which we wish to ascertain the relations, by examining their position in particular instances.

No. VI.—*General Form of Analysis where the Inquiry is limited to a class, or to any given number, of Circumstances.*

Class†.A	Signs.*	Circumstances,							
		belonging to the class.				occurring collaterally.			
Instances.									
	a								
	b								
	c								
	d								
	e								
	f								
	g								
	h								
	i								
	j								
	k								
	l								
	m								
	n								
	o								
	p								
	q								
	r								
	s								
	t &c.								
Classification of the Signs. Class.	A								
Sub-Classes.	*a*								
	b								
	c								
	d								
	e								

The sixth table, like the first, will admit of various modifications in order to fit it for receiving the classes of different circumstances. One of these, the seventh table, is the method of double signs adapted to inquiries where the circumstances are limited, but the instances very numerous.

No. VII.—*Form for the Analysis of a limited number of Circumstances, where the Instances are very numerous.*

*		Signs.	Circumstances.							Signs.	*
Instances.											Instances.
		a								*a*	
		b								*b*	
		c &c.								*c &c.*	
Classification of the Signs.	Class.									Class.	Classification of the Signs.
	Sub-classes.									Sub-classes.	

The eighth table presents a form by which the second process of the induction, classification by negative circumstances, is combined with a common register in the same manner as in table No V. It is used by giving a common sign to the circumstances under investigation, which may themselves be considered of the same class hypothetically, and by changing the sign of the class for the sign of the instance wherever any of the

circumstances are found deficient.—In the open space * of the heading, the subject of inquiry is to be entered with the common sign affixed.

No. VIII.—*Form for combining the method of Classification by negative circumstances with a common Register.*

* Instances.	Signs.	Circumstances.									
	a	A	A	A	A	A					
	b		b		b	A					
	c &c.					c					
Classification of the Signs. Class.	A	A									
	b		b		b						
Sub-classes.	c					c					

It may be convenient or necessary, as has been already observed, before proceeding to the second process of induction, the classification by negative circumstances, to continue the classification affirmatively through a greater number of instances. The ninth table, therefore, affords the form for doing so by the process of rectifying the signs. This table also admits of various alterations in the construction, which may tend to facilitate its application to different subjects, but I think it superfluous to describe them.

No. IX.—*General Form for extending, by the process of Rectification, the Classification by affirmative circumstances to a greater number of Instances.*

* Circumstances as they present themselves in the different classifications.	Rectification of the Different Series of Classifications.								Classifications of Different Series of Instances.																	
									Series No. I.						Series No. II.						Series No. III.					
	A	B	C	D	E	F	G	H &c.	A	B	C	D	E	F &c	A	B	C	D	E	F &c.	A	B	C	D	E	F & c

Having subjected the instances which form the materials of the investigation, to the operation of the two opposite processes of classification, by *affirmative* and *negative* circumstances, we must now collect together the results of the analysis in such a manner that they may all stand related to each other according to their natural affinities, or as they have been found most constantly conjoined in the different instances. The tenth table (which from the assistance it affords for that process, has been called the table of *Synthesis*) presents a form to answer this object, where all the circumstances being arranged under the respective signs of their classes or sub-classes, we are able to trace the connexions which exist between them. I have often thought that it would be possible to represent these connexions by lines drawn between the circumstances related together, which all issuing from the class to which they belong, and diverging to the circumstances of the other classes and sub-classes, would form a kind of *tree* of natural relations.—It is unnecessary to repeat that the classes are those circumstances which, assorted together by the first process of classification, remain after the class has been submitted to the second process, whilst the sub-classes are the circumstances which have been separated from the class by that process.

No. X.—SYNTHESIS.

Classes.		**Sub-Classes.*					
A.		*a*	*b*	*c*	*d*	*e*	*f*, &c.
B.		*a*	*b*	*c*	*d*	*e*	*f*, &c.
C.		*a*	*b*	*c*	*d*	*e*	*f*, &c.
D.		*a*	*b*	*c*	*d*	*e*	*f*, &c.
E.		*a*	*b*	*c*	*d*	*e*	*f*, &c.

As nothing assists analysis more than comparison or makes us more intimately acquainted with individual instances and their particular distinctions, I have thought it might be useful to subjoin some forms for comparing together different series of instances, either collectively or individually, as well as for ascertaining the relative position and coincidence of their different circumstances. Thus tables XI, XII and XIII are different forms for the first purpose; and XIV and XV for the latter.

No. XI.—*Form for comparing two Series of Instances with one another, individually.*

*	Classification of the Signs of the First Series.						Instances.					Classification of the Signs of the Second Series.						*
							I.	II.	III.	IV.	V. &c.							
Circumstances.	A	B	C	D	E	F &c.	A.a	B.b	C.c	D.d	E.e	a	b	c	d	e	f &c.	Circumstances.

No. XII.—*Form for comparing two Series of Instances with one another, collectively.*

*	Classification of the Signs of the First Series.					Instances.				Instances.				Classification of the Signs of the Second Series.					*
Circumstances.	A	B	C	D	E &c.	A	B	C	D &c.	A	B	C	D &c.	A	B	C	D	E &c	Circumstances.

No. XIII.—*Form for comparing with one another, individually, the Instance of two different series.*

*	Classification of the Signs of the First Series.					Instances.					Classification of the Signs of the Second Series.					*
Circumstances.	A	B	C	D	E &c.	A.a.	B.b.	C.c.	D.d.	E.e.	a	b	c	d	e &c.	Circumstances.

No. XIV.—*Form for determining the Coincidence of two Series of Events or Circumstances.*

Instances.	Series of Circumstances of which the order is most uncertain.	Signs.	Series of Circumstances of which the order is best determined with their Signs.							
			I.	II.	III.	IV.	V.	VI.	VII.	VIII &c.
			A.	B.	C.	D.	E.	F.	G.	H. &c.
		a								
		b								
		c								
		d								
		e								
		f								
		g								
		h								
		i								
		j								
		k								
		l								
		m								
		n								
		o								
		p								
		q								
		r								
		s								
		t &c.								
Combination of the signs of the prevailing coincidences.										

No. XV.—*Form for examining a given Coincidence between two Series of Circumstances.*

	Classification of the Signs of the First Series.					Instances.					Classification of the Signs of the Second Series.					
						I.	II.	III.	IV.	V. &c.						
Circumstances.	A	B	C	D	E	A.a	B.b	C.c	D.d	E.e	a	b	c	d	e	Circumstances.

CHAPTER V.

APPLICATION OF THE METHOD OF INDUCTION BY CLASSIFICATION TO PARTICULAR SUBJECTS.

L' instrument universel ne peut devenir trop étendu, trop maniable, trop aisé à appliquer à tout ce qu' on voudra : il est utile de l'utilité de toutes les sciences qui ne sçauroient se passer de son secours. *Fontenelle.*

A VERY cursory view of the present state of those branches of knowledge derived purely from observation, and, indeed, of some even of those which enjoy the privilege of experiment, must be sufficient to convince any one how much all might be improved by the application of a severe and correct analysis, and how much injury the greater number of them sustain from the neglect of it. And I am also inclined to think that the necessity of a more accurate induction is every day increasing, and has, in no inconsiderable degree, been produced by the desire and thirst after knowledge which distinguish the days in which we live ; for they have led to a hurried accumulation of matter without adequate care or judgment. Assertions have been received as facts upon insufficient evidence, and the love of

what is new has too frequently obtained the admission of what is false. Nor, when the method of observation has been true, has it always been judicious. Facts have been collected without reference to any use or object, have been heaped together without any order or arrangement, and have grown to a mass so disproportionate to the power of digesting and appropriating them, that we may almost apprehend from the confusion of our materials what was formerly suffered from the want of them.* From this admixture of error with truth, some branches of knowledge, being incapable of practical applications, remain barren and unproductive, whilst others, oppressed with their burden of materials, are prevented from advancing. It would be difficult to find in either of the great divisions of natural knowledge, moral or physical, an exception to these remarks; but it is necessary that I should content myself with suggesting the application of this method of analysis only to a few particular subjects, rather because they stand the most in need of it, than that others might be less benefitted by it.

* Talora vi cadrà in acconcio di paragonare lo sperimentatore all' uomo stravagante, che raccogliesse da per tutto, e amassasse materiali per fabbricare; ma che tutto accozzando alla rinfusa, senza criterio e senza scelta, ingombrasse il terreno appunto su cui erger la fabbrica, o ne confondesse talmente i materiali, onde nissun partito trarre esso stesso, e lasciar i posteri nella impossibilità di trarne alcuno considerevole dalle sue fatiche.

Rasori.

Section 1.—*Medicine.*

I have placed medicine at the head of the subjects to which I would recommend the application of the method of analysis by classification, because I feel myself fully warranted, by long and ample experience, in affirming, that, whether it be considered in its scientific relations, or in its practical details, no department of knowledge so urgently demands the wholesome reform of a close and scrutinising induction.

Although the practice of medicine must be admitted to be unquestionably one of the most difficult of all the arts, it is still no easy matter to answer the question, which may very fairly be asked, why the art of physick, one of daily necessity and of daily exercise, should have improved so slowly, and been so devious and unsteady in its progress, and that after a written experience of more than two thousand years, it should still remain an instrument of such doubtful and uncertain application. I am by no means of opinion that the complex nature of the subject* which forms the

* Subjectum istud *medicinæ* (corpus nimirùm humanum) ex omnibus quæ natura procreavit, maximè est capax remedii, et vicissim illud remedium maximè est obnoxium errori. Eadem namque subjecti subtilitas et varietas, ut magnam medendi facultatem præbet, sic magnam etiam aberrandi facilitatem. Quo circa quem admodum ars ista (quo præsertim nunc habetur modo) inter præcipuè conjecturales ; ita inquisitio ejus reponenda est inter summè arduas et accuratas.

business of medical research and of medical operation, furnishes a satisfactory explanation of this anomaly. The phenomena of health and of disease, the effects of food, of remedies, and of every agent capable of exerting an influence upon the living body, are objects of simple observation, are as cognizable as any other class of facts, and as certainly subject to a regular order as any other series of events. No one, arguing only from the past, has a right to say that this order is beyond the reach of observation, or that it is impossible to establish certain fixed principles concerning the manner in which these phenomena and these effects have place. And, consequently, no one has a right to deny that it may yet be possible to establish corresponding principles concerning the manner of producing these phenomena by art, of preventing them from taking place, or "in quantum fert mortalium sors," of arresting their progress. If these propositions, which are the general and compressed argument of Cabanis, be fairly put, it follows, that the cause of the uncertainty of medicine is not so much to be sought for in the difficulty of the subject as in the manner of observing and of studying it.

Medicine never continued long an art of unbiassed observation, and has never yet known the powerful and fertilizing influence of the inductive logic. In it no method of observation has been

made a rule of general use, but either, on the one hand, too nearly allied to philosophy,

—— "premendo littus iniquum,"

it has been led astray by the fanciful doctrines of dogmatising theorists, or, on the other, too servilely enchained in the routine of art, "vaga enim experientia et se tantum sequens," it has remained in a vicious circle of imitation. Independent observers, intuitively following the natural methods of their own suggestion, "ingenium rebus submittentem," have at distant times appeared scattered like the *Oases* of the desert; and though they have never failed to give a remarkable impulse to the progress of medicine, their disciples have not long pursued the track opened for them by the genius of the master, and the method and the example have gradually fallen into disuse and neglect. The consequence of this is, that the age of experience in medicine is almost limited to the life of each individual, and, instead of resembling a stream, gradually enlarging as it descends, by fresh accessions of knowledge, it consists of insulated parts, often in opposition, seldom in correspondence with each other.

It is therefore not without good reason, that one of the most sensible philosophers of our days has observed, that although "there is hardly any one branch of human knowledge in which men in general are more disposed to boast of the lights of

experience than in the practice of medicine, it would perhaps have been better for the world if some qualifying epithet had been invariably added to the word *experience*, to show with how very great latitude it is to be understood when applied to the evidence on which the physician proceeds in the exercise of his art." "The truth is," he continues, "that even on the most favourable supposition this evidence, so far as it rests on experience, is weakened or destroyed by the uncertain conditions of any new case to which his former results are to be applied; and that without a peculiar sagacity and discrimination in marking not only the resembling but the characteristical features of disorders, classed under the same technical name, his practice cannot with propriety be said to be guided by any one rational principle of decision, but only by blind and random conjecture. The more successfully this sagacity and discrimination are exercised, the more nearly does the evidence of medical practice approach to that of *experience;* but in every instance without exception, so immense is the distance between them, as to render the meaning of the word experience, when applied to medicine, essentially different from its import in those sciences, where it is possible for us, in all cases, by due attention to the circumstances of an experiment, to predict its result with an almost infallible certainty."* It was probably the same

* Stewart's Philosophy of the Human Mind.

view of medical evidence which led the celebrated La Place to convey that severe censure on the practice of medicine, of proposing to submit it to the mathematical doctrine of chances.

But it must be recollected that these opinions are only well founded when confined to the past and present method of medical research, and that they fall to the ground if meant to deny the possible improvement of evidence in medicine under the influence of a successful induction. Medicine is not a science of experience in the same sense as the other sciences, for no other reason than because the instrument and the art of experience have never yet been applied to it. Were it possible to place medical facts within the grasp of induction, medicine must necessarily stand on the same footing as any other science of observation, perhaps of experiment. The materials of experience are not wanting. The stores are ample and well furnished. Every day is busy in producing more, and perhaps of a better kind. There is nothing intrinsically in the nature of the facts which are of the province of medicine which prevents them from being analysed and reduced to order, and from being thus made to contribute more or less to the common stock of experience. The analysis of medical observations is no doubt beset with some difficulties which are only to be overcome by the united labours of many, and by repeated efforts; but if this important work was only undertaken in

a right spirit, and steadily persevered in—if the method of observing was reformed, if the observations were subjected to the assay of a searching induction, it is impossible to foretell what might be the happy results; and certainly not before such a trial has been fairly made, is it allowable to say, that medicine cannot be elevated to the rank of the other sciences. This is no new view of the matter, no enthusiastic anticipation, the offspring of a new theory. It is the opinion of Sydenham* and Baglivi,† equally disciples of Hippocrates and of Bacon, and the two most illustrious names, who,

* Si vel unus tantum per singula mundi secula hoc modo unicum tractaverit morbum, medendi ars, (quæ medicorum est provincia,) à multis retro annis ad *ἀκμὴν* pervenisset, *omnibus absoluta numeris*, saltem in quantum fert mortalium sors.

† Enim vero dum tota medicinæ prudentia in eo posita videatur, ut morbum cum morbo, tempus cum tempore, hominem cum homine compares, quo advenientia, et crescentia mala suis certis signis, ac nominibus ea distinguere, iisdemque idonea aptave remedia adhibere queas, nemo certè inficias iverit, nullam prorsus, et nobilissimæ scientiæ exornandæ, et curandis hominibus utiliorem operam navari posse, quam si præstantissimæ artis studiosi, immenso retro tempore jam factas a majoribus nostris observationes attenderent, novasque in dies animadverterent ac notarent. Quam quidem promovendæ artis rationem, si jam inde ab Hippocratis temporibus ad hanc nostram usque ætatem constanter homines retinuissent, dici vix potest, quot quantique progressus hac hodie parte haberentur. Cum vero rem alioqui adeo necessariam, tam præclaram, atque ita feliciter institutam reliquerint, ut se infinitis et (ut Apostoli verbis utar) *interminatis quæstionibus*, *λογομαχιας* implicarent, aliam afferre causam non possem, quam offensi, ac ulsciscentis Numinis iram.

since the revival of letters, have honoured and adorned our art.

When these researches first occupied my attention, it is fit to confess that my hopes of the advancement of medicine were neither sanguine nor consoling, but on the contrary, having long been disappointed with the results which follow the synthetical method in the study as well as in the practice of physick, I found myself obliged to acknowledge that the only way to increase the certainty of our art, was to return directly to a state of pure empyricism, (confining that term to its original and literal meaning.) I was reduced to the opinion that precision in practice could only be ensured by a kind of imitation or *transduction* from one individual case to another, instead of raising general principles from many individual cases, and again applying these principles to new cases. In short, forgetting that the disappointments of which I had to complain, might with more justice be attributed to want of skill in the artists, than to want of power in the art, "errores non artis sed artificum," I utterly despaired of ever beholding the practice of medicine proceed in the broad day-light of induction, and was fully prepared to confine myself to the humbler but more practical method of imitation, of which, as has been already observed, Lord Bacon has left us an outline in his "*experientia literata.*" It was in endeavouring to perfect this method, and adapt it

more particularly to the practice of medicine, that I was led to the tabular analysis. And having considered the nature of the subject with more attention, and viewed it in all its bearings, and having seen reason for better hopes in the increasing resources of induction, of which, as has been already observed, the practice of medicine has yet felt the influence only imperfectly, I am encouraged to indulge the most confident expectations; and, in availing myself of the words, I am inclined to adopt the opinion of Cabanis, in its fullest extent.

"Oui, j'ose le prédire: avec le véritable esprit d'observation, l'esprit philosophique qui doit y présider va renaître dans la médecine; la science va prendre une face nouvelle. On réunira ses fragmens épars, pour en former un système simple et fécond comme les lois de la nature. Après avoir parcoura tous les faits; après les avoir revus, vérifiés, comparés, on les enchaînera, on les rapportera tous à un petit nombre des point fixes, ou peu variables. On perfectionnera l'art de les étudier, de les lier entre eux par leurs analogies, ou par leurs différences, d'en tirer des regles générales, qui ne seront que leur énoncé même, mais plus précis. On simplifiera surtout l'art, plus important et plus difficile, de faire l'application de ces règles à la pratique. Alors, chaque médecin ne sera pas forcé de se créer ses méthodes et ses instrumens; d'oublier ce qu'on apprend dans les écoles, pour

chercher dans ses propres sensations ce qu'il demanderoit vainement à celles d'autrui; je veux dire des tableaux, non seulement bien circonstanciés et d'une vérité scrupuleuse, mais formant un tout dont les diverses parties soient coordonnées. Alors, il ne sera plus nécessaire que le talent se mette sans cesse à la place de l'art : l'art ou contraire dirigera toujours le talent, le fera naître quelquefois, semblera même en tenir lieu. Non que je croie possible de suppléer, par la précision des procédés, à la finesse du tact, et aux combinaisons d'un genie heureux : mais le tact ne sera plus égaré par des images vagues, et incohérentes, ni le génie enchaîné par des règles frivoles et trompeuses ; ils ne rencontreront plus, ni l'un ni l'autre, aucun obstacle à leur entier développement. Alors, des esprits médiocres feront peut être avec facilitè ce que des esprits éminens ne font aujourd'hui qu'avec peine : et la pratique dépouillée de tout ce fatras étranger qui l'offusque, se réduisant à des indications simples, distinctes, méthodiques, acquerra toute la certitude que comporte la nature mobile des objets sur lesquels elle s'exerce."

But, concerning the views which I entertain of the means of advancing the progress of medicine, I think it proper to explain that it is not from the cultivation of medicine in specialties and dismembered parts that I augur much good. Indeed I am not aware of any thing which has been more adverse to the diffusion of correct notions, and

more opposed to the establishment of truth in medicine, than the division of its study into different branches, thus separating the consideration of the causes of disease from the phenomena which they present, and from the method of treating them. It is essential to successful practice that all their parts should be preserved in exact correspondence with each other. Diseases must be considered and contemplated entire in all their parts, and complete in all their circumstances, from their origin to their termination.

I am therefore not of the number of those who expect that the power of medicine in controlling disease, is to be greatly increased or extended by *curative indications* deduced from the phenomena which the scalpel can disclose. These, at best, can present only a fraction of the data upon which must be founded any deduction for the successful treatment of a disease. If I do not much mistake, the assistance to be derived from the study of morbid anatomy, can be only indirect, and must be confined to the help it may afford towards individualising diseases, if I may so speak; for by demanding a closer observation of particular cases it may facilitate the application of specific methods of treatment to specific cases. But the practical application of remedies must be deduced from the knowledge of their effect upon the living body in cases as nearly similar as

can be asertained by observation, not from the relation of any remedy to the appearances which may be found in the dead subject. "A certis potius et exploratis petendum esse presidium; id est, his quæ experientia in ipsis curationibus docuerit."

In like manner I have little hopes of the improvement of medicine by the exclusive study of therapeutics. Some physicians would have us think that the power of medicine is to be vastly enlarged by the discovery of specific remedies for particular diseases, or of new agents capable of modifying or removing diseased actions. But the experience of ages forbids us to indulge in these expectations Not more than two or three such remedies are known to exist. And although it may be unphilosophical to deny that more may yet be formed in the great store-house of nature, it is surely more prudent to make a proper use of the means of which we are already possessed, than to neglect them for dreams of hidden treasure. It is surely more wise to avail ourselves of the resources we can command, by endeavouring to increase the certainty and safety of their use and application, that by establishing more definite relations between particular cases, and particular cures, all which the sick suffer from error or misapplication, may be spared them.

The means which my views of the improvement of medicine embrace are neither many nor com-

plicated. They may be comprehended in a few words,—true, distinct, circumstantial observation,—clear, severe, searching analysis. I do not wish it to be imagined that I would reject any elucidations which the collateral sciences are capable of furnishing. So far as these explain and illustrate the symptoms of diseases they increase the circumstances and extend the means of distinguishing them. In this way, chemistry, experimental philosophy, and some other sciences, may supply us with useful assistance. But the danger is of allowing these means to rank above their proper subordinate position; for the most baneful consequences have been the result, where practical conclusions have been deduced from such data. "Rationalem quidem puto medicinam esse debêre; instrui verò ab evidentibus causis, *obscuris omnibus non a cogitatione artificis sed ab ipsa arte rejectis.*"

An improved method of the study and, consequently, of the practice of medcine is, however, only to be expected from an improved method of education. My meaning will be quite misunderstood, if it is supposed that I imagine, that such an object can in any degree be obtained by the additional studies which have of late years been imposed upon those qualifying themselves for the practice of the healing art, in all its different branches. No doubt such studies may contribute much to the general accomplishment of the physician, and, giving him a more entire

view of nature, by enlarging his comprehension, may increase his resources. But these advantages, seldom felt by more than a few individuals happily gifted, are altogether subordinate to the principle object of medical education considered in relation to the many. My notions of the improvement of medical education are in every respect opposed to these alterations, and relate more to the method of teaching, than to the matter which is taught. It seems indeed to me by far more natural that the student should pursue the same course in acquiring the knowledge of his profession in the schools, which he must in after life follow in his practice, and that the synthetical teaching from the chair should be replaced by analytical observation in the hospital. I cannot help thinking that instead of acquiring a superficial acquaintance of sciences, sometimes remote, generally irrelevant, and which do certainly in many instances tend to establish habits of the mind by no means favourable to the practical details of medicine, it would be a more advantageous employment of the period of study, if the pupil were instructed and exercised in the right use and application of the true method of observation, which in active life must be the guide and the instrument of his professional labours. What would be said of a method of teaching any art in which every thing was attended to, except the easy and skilful

manner of handling the tools and utensils which the artist must employ! Such a *preposterous* manner of proceeding could not be more inconsistent than what is to this very day committed in the method of teaching the practice of the art of physic, where the inductive logic which must preside over and regulate the reasoning of the physician, forms no part of any system of medical education. And indeed I must own that the habits of the mind which the practice of medicine demands, and consequently tends to produce, is a circumstance but very imperfectly understood, and has by no means received that attention which both as an object of interest and as a matter of usefulness, it is equally entitled to.

But the method of observation would be best taught by example in the practice of an hospital, and were hospitals organized upon proper principles, with a due regard to the patient, the pupil, and the public, all their details might be made subservient to one general method of observation, and the whole might present a continued process of analysis.

In sketching the following plan of an *analytical hospital,* I think it proper to premise that I entertain no notion so visionary as to hope to see it carried into effect. I have not known the profession of medicine more than twenty years to remain ignorant of the invincible prejudices of habit. But still I am not the less convinced

that until this, or some other method of teaching medicine inductively, shall come into general use, the public must be content to suffer from the misapplication of the art, and Medicine must endure the dishonour.

I am of opinion that the student having been thoroughly disciplined in classical and mathematical learning, (*quamvis non faciat medicum, aptiorem tamen medicinæ reddit,*) and having been prepared by an adequate acquaintance with anatomy, physiology, chemistry, and materia medica, should at once proceed to the hospital. It is there, I think, that his knowledge of diseases ought to commence, so that he might know nothing of their symptoms by name, before he has made himself familiar with the reality. The symptoms of disease should be first demonstrated to him on the living subject, after the manner of teaching natural history, and not until he has acquired a distinct notion of them and understood them accurately, ought he to learn the names by which they are technically distinguished.* He should first become acquainted

* Les connoissances qu'on acquiert dans les écoles, ou dans les livres, ne peuvent donner ni cultiver la sagacité des sens :— Les vraies connoissances de notre art ne sont qu'un ensemble, plus ou moins complet, des sensation recuillies au lit des malades ; ces sensations ne peuvent être fournies, que par les objets mêmes qui les produisent. Ainsi la lecture, à proprement parler, ne nous enseigne, en quelque sorte, que ce que nous savons déjà.

Cabanis.

with diseases in individual cases and afterwards proceed by degrees to their common features and generic characters, according to the natural order of induction. The distribution and classification of the cases of disease in the different wards, ought to be such as to favor this method of study. Thus the same diseases, or those allied to each other, should be placed together, that the mind being occupied with one class of diseases might become fully conversant with them; whilst the comparison of individual cases of the same disease being forced upon the attention by their juxta-position, would point out their peculiarities and specifical distinctions, and would explain and account for the exceptions and modifications of the general method of treatment.

In such an hospital, every ward ought to have its own physician, and every physician should be a professor of clinical medicine, who with his pupils, all mutually cooperating with each other, should form a well organised corps of observers. The students should be divided into two classes, senior and junior, and every case of disease should be entrusted to two students, one of each class. The senior student should be accustomed to demonstrate and explain the symptoms and phenomena of disease to his junior colleague, and it should be the duty of both to register and report, with fidelity and correctness, every circumstance as it presents itself in the course of the disease. To monitors or students

still more advanced should be committed the task of observing and recording all the general and common circumstances having an influence upon all the diseases, as the weather, temperature of the air, temperature of the ward, the prevailing constitution of the atmosphere, and such like; and to other monitors should be entrusted the superintendence of all the journals, and the care of analysing the different cases. To the physician himself should exclusively belong the direction of the treatment, and explanatory lectures on the nature of the diseases. He should point out, by comparing and contrasting different cases of the same disease, their general resemblance and their particular distinctions; and, in order to be assured that the subordinate duties were punctually performed, the students should be subjected to occasional examinations.

On each case being received into the ward, the causes or circumstances preceding the disease, the particulars of any previous treatment, and the period of the disease, should be minutely investigated and carefully noted, and, as the disease proceeded, every symptom which it presented, every agent of whatever kind capable in any way of influencing the disease and the effects of such agents, should be scrupulously watched and distinctly described. On the case being brought to a termination, whether successful or otherwise, the history of it should be handed

over to the monitor charged with the duty of analysis. By submitting the case to the operation of the analytical table, he would easily determine the relations of its different circumstances to one another, and the agreement or disagreement of the circumstances of different cases of the same disease, and he would thus learn to draw accurate and well founded conclusions accordingly. This office should be filled by the best instructed pupil, that, in this manner, every student rising gradually from the simple to the analytical observer, would be initiated in the art of correct observation, and, having thus been daily exercised in the practice of induction, would pass from the hospital to the world, well trained in the use of that instrument which must be the guide of his professional life.

Having studied the diseases of one ward and gradually risen from the lowest to the highest station of observation, the pupil should proceed to study the diseases of another ward, under another professor of clinical medicine, and so on successively, until having become familiar with the diseases of all the wards, his course of clinical education would be completed. It would then be the fit time for him to listen to the generalities of the chair, to hear all that is known, all the opinions which have been entertained, of the nature of diseases, and all the various methods which have been suggested or followed

for their cure. Or, instead of reserving a general course of lectures on the practice of Medicine for the termination of the clinical studies, each clinical professor might partly provide for this object by delivering lectures on the general nature of the diseases of his wards, as well as particular lectures on individual cases of disease, as is at present the custom. Under either plan, the student will be in a position to derive the full advantage of such lectures; for, understanding the language of the art, and being able to compare what is said with what he has seen, he will begin to exercise his own judgment and to appeal to his own experience.

In order, however, to give unity to the plan and co-operation to the parts of such an analytical hospital, it would be important that all the machinery should be under the regulating control of one directing head, to whom all should be amenable for the right performance of their respective duties. This directing physician might be charged with the general lectures on the practice of medicine, but his chief business ought to be to inspect the patients on their reception into the hospital, to distribute them to their appropriate wards, and to register, in a book kept for that purpose, every particular concerning them which it may be important to record. As each case was brought to a termination, the nature of the event should be reported to him, and the patients being examined by him on their discharge, as well as on

their entrance, he would have a checque on the practice of the different physicians, without, however, interfering with them in the general management of their wards, or in the particular treatment of the diseases. Besides this, at stated periods, the physician of each ward should be required to submit to the directing physician full analytical reports of the diseases treated in each ward; which being circumstantial, might be at last incorporated with the general analysis of each disease, and ought to be carefully preserved in the archives of the hospital. These successive processes being performed analytically, their recorded results would occupy a comparatively trifling volume, and each hospital would thus be in possession of a code of experience, every day extending the usefulness, and diminishing the uncertainty, of the art of physick.

Form for the MEDICAL ARCHIVES *of an Hospital, for recording the results of Experience in Diseases, Analytically deduced.*

*

Classes.		*Sub-Classes.*							
	†	‡	*a* †	‡	*b* †	‡	*c* †	‡	*d*, &c. †
A.									
			a		*b*		*c*		*d*, &c.
B.									
			a		*b*		*c*		*d*, &c.
C.									
			a		*b*		*c*		*d*, &c.
D.									
			a		*b*		*c*		*d*, &c.
E.									

* Name of Disease to be inserted in this space.

† The circumstances or particulars of the disease to be inserted in these columns, each under their respective signs, and according to their relation to each other, as determined by analysis.

‡ These columns are for the insertion of references to the cases, or series of cases, in which the circumstances have been found.

In this manner also, each physician would be subject to a proper responsibility in the discharge of his duties, and the estimation of his practice being founded on the circumstances of the cases and not on the event alone, his professional character would not be decided as heretofore, by the uncertain evidence of single cases, but his merits would be established upon the general tenour of his practice. "Medicus et fortasse politicus, vix habet actiones aliquas proprias, quibus specimen artis et virtutis suæ liquidò exhibeant; sed ab eventu præcipuè honorem aut dedecus reportant, *iniquissimo prorsùs judicio.*" And I must take leave to say that such a measure of responsibility is only in justice demanded of those who fill a situation so important to society, as that of physician to a public hospital.*

* *Vide*, Form p. 129.

* *Form of an Hospital Receiving Book, by which the Practice of Physicians in Particular Diseases may be estimated analytically.*

*	Circumstances of each case with their Signs.																		
Names of Patients.	Signs.	Age.	Sex.	Social Relation.	Trade or Occupation.	General Habits of Life.	General State of Health.	Season of Year.	Prevailing Epidemic Constitution	Age of Disease on reception.	If had any treatment for disease before reception.	EVENTS.					No. of Ward.	Name of Physician.
												Duration of Treatment	Cured.	Relieved.	Remain in same State.	Died.		
		A	A															
	A																	
	B																	
	C																	
	D																	
	E																	
	F &c.																	
	A																	
	B																	
Classification of the Signs.	C																	
	D																	
	E &c.																	

* Name of Disease to be inserted in this open space.

I cannot help expressing my regret that the opportunities lately afforded in establishing the medical schools of the London University and King's College, have not been made use of to introduce an example of the method of teaching medicine analytically: and that a fresher spirit of analysis, more becoming the temper of the age, had not more generally pervaded the organization of these institutions. It is, indeed, full time that the spirit of the Novum Organon presided more entirely over the constitution of our public academies, and that a chair, at least, was exclusively devoted to teaching explaining, and cultivating the vast resources of the inductive philosophy. It is not easy to calculate what might have been the general and remote consequences of a practical example of medical induction, but those who are at all conversant with the matter, can have little hesitation in admitting, that, by sending into the world men well exercised in the practical details of medicine, and already accomplished in the method of correct observation, the interests of society at large would have been most wisely consulted, and such advantages, not to be obtained elsewhere, would have most certainly ensured the success of these institutions.

It appears to me this method of acquiring the knowledge of the practice of medicine, might also be sufficiently well pursued in apprenticeships, were their terms and conditions reformed and placed upon a proper footing; the duties of the

master being made as imperative as those of the pupil. Thus, if no one was admissible as an apprentice, until he had, after a proper classical education, attended courses of anatomy, chemistry, and materia medica, he would be prepared for entering upon the observation of disease, and might pass two or three years under the superintendence of a practitioner, whose duty it should be, instead of only confining him as at present to the drudgery of pharmacy, to demonstrate and explain to him the phenomena of disease, and the methods of treatment, thus serving, as it were, for his clinical guide. Nor ought apprentices to be confined only to general practitioners. Physicians ought also to have their apprenticed pupils, which, by the nature of the present regulations and institutions, is denied them.

In order to promote the use of a better analysis, and facilitate the application *to medicine* of the *method of induction by classification,* I have drawn up the following plan of a book of analysis, that any medical observer may at once be able to construct and prepare one for his own use.

THE BOOK

OF

MEDICAL ANALYSIS,

OR

GUIDE

FOR STUDYING

FAITHFULLY FROM NATURE.

Ἐν νόῳ καὶ τὰ περὶ νούσων ἰήσιος, καὶ οἱ τοιουτέων τρόποι, ὀσαχῶς, καὶ ὃν τρόπον περὶ ἑκάστων ἔχουσιν· αὕτη γὰρ ἀρχὴ ἐν ἰητρικῇ, καὶ μέσα καὶ τελος.

ΙΠΠΟΚΡΑΤΗΣ *περὶ* ΕΥΣΧΕΜΟΣΥΝΗΣ.

DIRECTIONS

FOR THE USE OF

THE BOOK OF ANALYSIS.

In order to ensure true and correct results by this method of analysis, it is first necessary to collect full, entire, and circumstantial histories of particular cases of disease, and it is next of importance to use, as near as possible, the same terms, for the same circumstances, whether they be causes, symptoms, or remedies. But it is not meant to exclude those variations of expressions, and shades of distinctions which lead to fine and delicate observation, for these may be faithfully given by the modifications of the signs as has been already explained.*

As I have not yet been able to succeed in making the analytical table serve the purpose of a daily journal of cases, so as to carry on the analysis from day to day, through the whole history of the disease, (which would indeed be to give it the highest degree of perfection,) it will be necessary that the observer should select from

* Vide supra, Chap. I.

cases, either detailed by others, or observed by himself, every particular or circumstance which can be supposed to have any influence on the results, and insert them in order, in such an analytical form, as may seem best adapted to the case. As soon as a case of disease presents itself for observation, he will appropriate a form to that disease, by writing its name in the open space* left for that purpose, and proceed to write down, in the column of circumstances,† the causes of the disease, whether predisposing or exciting, the symptoms in their order of succession, the particulars of the method of treatment, the effects of remedies, the nature of the event, and the duration of the disease. Opposite to each of these circumstances, he will place the sign of the case in its proper column.¶ That similar circumstances of different cases may succeed each other in the order of their occurrence, it is convenient to leave open lines for their insertion, between the circumstances of the first cases, and, as the period of the disease in which these circumstances occur may constitute an important element in the induction, it may be expressed by placing the day of the disease, in figures, over the sign of the circumstance. It will thus be easy to perceive how the same circumstance varies in different cases, as to the period of the disease in which it takes place, and to trace the influence of this variation upon the consecutive circumstances.

*. †. ¶. Vide infra, Forms for the analysis of diseases.

When another case of the same disease is submitted to examination, the circumstances are to be selected as in the first case. Those which have already been found in the first case will be expressed by repeating the sign of that case in the column of the second case, but such as have not been found before in the first case, must be written down in the column of circumstances, and have the sign of the second case placed against them in its proper column. This process, the *translation of circumstances into signs*, is to be repeated, in the same manner, in all the subsequent cases, so that the same circumstance in every case may be invariably denoted by the same sign, but different circumstances by different signs, each proper to the case in which it occurs. But as the same circumstance may present itself in different cases, in a less or a greater degree, it is proper that this should be distinguished and denoted by the signs of modifications, according to the principles explained in the first chapter.*

So soon as a table has received its complement of cases, the signs of the circumstances are to be collected together and classified, by placing under its proper sign, in the column of classification, the number of times the sign of any circumstance has been found in all the instances. This operation, as I have already explained,† shows what circumstances are connected together, and which have no

* Vide Chap. I. † Vide, Chap. I.

relation to each other. If the observer thinks that the cases examined afford sufficient data for his investigation, or that any class (such as are denoted by the same sign being considered to belong to the same class) indicates a connection existing between its circumstances sufficiently strong for a more particular scrutiny, he will then submit it to the second process of analysis, or exclusion by negative circumstances. This is performed by transfering the circumstances of the class to a table of the second form, by comparing them in new cases, and by changing the sign according to the rule given above.*

But if it should appear that the cases of one table do not afford data sufficiently extensive for deducing a conclusion, or that the classes of circumstances do none of them indicate relations worthy of further research, a new table must be opened for receiving another series of cases of the same disease; the classified signs of which must be placed in correspondence with those of the first table by the method of rectification as already explained.* By this plan the observer may continue his classification to a very great number of cases, and, being able to put them all in correspondence with each other, he will perceive the relations which connect together the circumstances of the same class; and by submitting any class to the second process of analysis, he

* Chap. I.

will discover the conditions and combinations which unite any particular circumstance with the other circumstances of its class. Having subjected every class to this process, the results may be transferred to a table of the fourth form, where the circumstances of the different classes and subclasses being all arranged under their respective signs, will be presented in the natural order of their relations, and will allow all the connections existing between them to be easily traced.

I have already stated that the period of the disease in which any circumstance occurs, may be expressed by placing the day of the disease over the sign of the circumstance, but the difference of acute and chronic diseases in this respect may require some modification in the form of their tables. This has led me to construct some tables with a column for inserting either the period of the disease in which a circumstance presents itself, or the limits of time between which it ranges. This modification of the general form may be applied accordingly as it is found more or less convenient.

Besides analyzing diseases in this manner, the observer may find it necessary to institute comparisons between different cases of the same disease, or between different series of cases, either collectively or individually, according as he may wish to trace the influence of different causes in the same disease, or to estimate the merits of different methods of treatment. Convenient modifications have been adopted to this object. The manner of

using them being precisely the same as for the analysis, their applications will easily suggest themselves.

There are always other collateral inquiries which present themselves to the medical observer, in the course of his investigations of disease, such as the general effects of particular medicines, the connection between symptoms of diseases and the morbid alterations of structure found on dissection, the coincidence of stethosopic signs with certain diseases of the chest, and many other similar researches which it may be desirable to promote. Appropriate forms have therefore been prepared for these purposes, which there can be no difficulty in applying to the particular subjects.

That nothing worthy of observation may escape attention, or be passed over, I recommend blank pages to be provided at the end of the book of analysis, for the purpose of writing, at full length, descriptions of any striking or remarkable cases or circumstances of a disease, and if to this be appended a proper analytical index of all the diseases examined, and of all their circumstances, alphabetically arranged, the observer, whether student or practitioner, will have provided for himself a body of experience of his own, easy to be consulted, such as no other method of study is capable of communicating.

FORM I. *a.—For the Analysis of Cases of Disease, where the Cases are numerous but the Circumstances of each case comparatively few.*

* Causes, predisposing and exciting; Symptoms in their order, duration, and period; Method of treatment, Nature of Event, Duration of disease.	Classification of the Signs.								Cases.									
	A	B	C	D	E	F	G	H &c.	I. A	II. B	III. C	IV. D	V. E	VI. F	VII. G	VIII. H	IX. I	X. &c. J &c
†																		

I. *b.—For the Analysis of Cases of Disease, where it is particularly desirable to mark the period, or the range of the periods, of the Circumstances.*

* Circumstances.	Days of the Disease.	Classification of the Signs.						Cases.									
		A	B	C	D	E	F &c.	I. A	II. B	III. C	IV. D	V. E	VI. F	VII. G	VIII. H	IX. &c. I &c

I. *c.—For the Analysis of Cases of Disease, where the Cases as well as their Circumstances are comparatively few.*

* Circumstances	Classification of the Signs.				Cases.					Cases.					Classification of the Signs.				* Circumstances.
	A	B	C	D &c.	I. A	II. B	III. C	IV. D	V. E &c.	I. A	II. B	III. C	IV. D	V. E &c.	A	B	C	D &c.	

FORM I. *d.—For the Analysis of Cases of Disease, where the Cases, as well as their circumstances, are comparatively few, but where it is necessary to mark the periods of the circumstances.*

*						Cases.				Cases.							*
Circumstances.	Days of the Disease.	Classification of the Signs.				I.	II.	III.	IV.	I.	II.	III.	IV.	Classification of the Signs.				Days of the Disease.	Circumstances.
		A	B	C	D &c.	A	B	C	D &c.	A	B	C	D	A	B	C	D &c.		

I. *e.—For the Analysis of Cases of Disease, where the Cases, as well as their circumstances, are comparatively numerous.*

*						Cases.									*
Causes, predisposing and exciting: Symptoms, their order, duration, and period.	Classification of the Signs.					I.	II.	III.	IV.	V.	Classification of the Signs					Methods of Treatment in their order; Nature of Event; Duration of Diease.
	A	B	C	D	E &c.	A.a.	B.b.	C.c.	D.d.	E.e.	a	b	c	d	e &c.	

I. *f.—For the Analysis of Cases of Disease, where the Cases and their circumstances are equally numerous, but where it may be of importance to mark the periods of the circumstances.*

*						Cases.										
Causes, predisposing and exciting: Symptoms in their order.	Days of the Disease.	Classification of the Signs.					I.	II.	III.	IV. &c.	Classification of the Signs.					Days of the Disease.	Methods of Treatment, in their order; Nature of Event; Duration of Disease.
		A	B	C	D	E &c.	A.a	B.b	C.c	D.d &c.	a	b	c	d	e &c.		

FORM I. *g.*—*For the Analysis of Cases of Disease, where the Circumstances are numerous but the cases few.*

*																						*		
History of Disease.		Classification of the Signs.					Cases.				Cases Continued.				Classification Continued.					Method of Treatment; Nature of Event; Durationof Disease.				
		A	B	C	D	E &c.	I. A	II. B	III. C	IV. &c. D &c.	I. A	II. B	III. C	IV. &c. D &c.	A	B	C	D	E &c.					
Causes.																							Remedies &c.	
																							Event.	
Symptoms.																							Duration.	

I. h.—*For the Analysis of Cases of Disease, where the Circumstances are numerous but the Cases few, but where it is important to ascertain the periods of the Circumstances.*

*																							*		
History of the Disease.	Days of the Disease.	Classification. of the Signs.					Cases.				Cases Continued.				Classification Continued.					Days of the Disease.	Method of Treatment; Nature of Event; Durationof Disease.				
		A	B	C	D	E &c.	I. A	II. B	III. C	IV. &c. D &c.	I. A	II. B	III. C	IV. &c. D &c.	A	B	C	D	E &c.						
Causes.																								Remedies, &c.	
																								Event.	
Symptoms.																								Duration.	

FORM I. *i.—For combining the method of Analysis with a Journal or Register, some of the Circumstances being written, but having their signs interlined if necessary.*

*		Cases.							
Circumstances.	Classification of the Signs.	I.	II.	III.	IV.	V.	VI.	VII.	VIII &c.
	A B C D &c.	A.	B.	C.	D.	E.	F.	G.	H.
Causes. Age.		A.	B.	C.					
Sex.									
Temperament.									
Previous Disease.									
Profession, Trade.									
Season of year, &c.									
Symptoms.									
Treatment.									
Event.									

FORM I. *j.*—*For determining the particular Effects of any Medicine upon the Body in health.*

*							Experiments.																		
State of body previous to taking the medicine; Effects following the use of the medicine, &c.	Classification of the Signs.						I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	XV.	XVI. &c.			
	A	B	C	D	E	F &c.	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P &c.			
(* The name of the Medicine to be inserted in this open space.)																									

I. *k.*—*For determining the particular effects of any Medicine upon the Body in a state of Disease, and for ascertaining the time and duration of its operation.*

*		†						Cases.															
Particular state of body previous to using the medicine; Form and quantity used; Effects following its use.	Period or Duration of Effects.	Classification of the Signs.						I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII. &c.				
		A	B	C	D	E	F &c.	A	B	C	D	E	F	G	H	I	J	K	L &c.				
(* The name of the medicine to be inserted here. † Space in which is to be written the name of the *disease* in which it is used.)																							

I. *l.*—*For comparing, with one another, two methods of treatment in different cases of the same Disease.*

*	†				Cases of First Series.					Cases of Second Series.					†				*
Circumstances.	Classification of Signs of First Series.														Classification of Signs of Second Series.				Circumstances.
	A.	B.	C.	D. &c.	A.	B.	C.	D.	E. &c.	A.	B.	C.	D.	E. &c.	A.	B.	C.	D &c.	
(* Space for inserting name of Disease. † for inserting the method of treatment.)																			

FORM I. *m.—For comparing, with one another, two methods of treatment in different cases of the same Disease, where it is of importance to note the periods of the Circumstances.*

*		†					Cases.				†					*	
Circumstances of the Cases of First Series.	Days of the Disease.	Classification of Signs of First Series.					I.	II.	III.	IV. &c.	Classification of Signs of Second Series.					Days of the Disease.	Circumstances of the Cases of Second Series.
		A	B	C	D	E &c.	A.a	B.b	C.c	D.d &c.	a	b	c	d	e &c.		

I. *n.—For comparing with one another* collectively, *two series of cases of different kinds of Diseases, between which it is desired to ascertain the points of resemblance and the points of distinction.*

*					Cases of 1st Series.					Cases of 2d Series.									*
Circumstances of the Cases.	Classification of Signs of 1st Series.				I.	II.	III.	IV.	V.	I.	II.	III.	IV.	V.	Classification of Signs of 2d Series.				Circumstances of the Cases.
	A	B	C	D &c.	A	B	C	D	E	A	B	C	D	E	A	B	C	D &c.	

I. *o.—For comparing, with one another* individually, *the cases of two different kinds of Diseases, where it is also of importance to note the date of the Circumstances.*

*							Cases of both Series											*	
Circumstances.	Days of the Disease.	Classification of the Signs.					I.	II.	III.	IV.	V.	Classification of the Signs					Days of the Disease.	Circumstances.	
		A	B	C	D	E &c.	A.a.	B.b.	C.c.	D.d.	E.e.	a	b	c	d	e &c.			

I. *p.—For determining the Relations between the Symptoms of Disease and the Morbid Appearances found on Dissection.*

Symptoms observed before death.	Classification of the Signs.					Dissections.					Classification of the Signs.					Morbid Appearances found after death.
	A	B	C	D	E &c.	I. A.a.	II. B.b.	III. C.c.	IV. D.d.	V. E.e.	a	b	c	d	e &c.	

FORM II. *a.—For investigating the Relations existing between the Circumstances of Disease classed together by the first process of Analysis.*

Class. * / Cases.	Signs.	Circumstances of the Class.							
		I. †	II. †	III. †	IV. †	V. †	VI. †	VII. †	VIII †
	a.								
	b.								
	c.								
(* The Sign of the Class to be inserted here. The circumstances to be written in these spaces.)	*d.*								
	e.								
	f.								
	g.								
	h.								
	i.&c.								
Class.	*								
Sub-Classes.	*a.*								
	b.								
	c.								
	d.								

II. *b.—For investigating the Relations between the Circumstances of the same Class, and for ascertaining their Combinations with the Circumstances of other Classes.*

Class. * / Cases.	Signs.	Circumstances.							
		belonging to the class.				occurring in combination.			
		I. †	II.	III.	IV.	I. †	II.	III.	IV.
	a.								
	b.								
	c.								
	d.								
	e.&c.								
Class.	*								
Sub-Classes.	*a.*								
	b.								
	c.								

FORM III. *a.—For connecting together, by the process of Rectification, the* ANALYSIS *of different series of Cases.*

* Circumstances.	Rectification of the Signs.				Classifications of different Series of Cases.													
					1st Series.					2d Series.					3d Series.			
	A	B	C	D &c.	A	B	C	D	E &c.	A	B	C	D	E &c.	A	B	C	D	E &c.

III. *b.—For placing in correspondence the Analyses of different Series of Observations by the process of Rectification.*

* Classifications of different Series of Observations.	Signs.	Circumstances.										
		I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.
1st Series.	A.											
	B.											
	C.											
	D &c.											
2nd Series.	A.											
	B.											
	C.											
	D &c.											
3rd Series.	A.											
	B.											
	C.											
	D &c.											
Rectification of the Signs.	A.											
	B.											
	C.											
	D.											
	E &c.											

FORM II. *c.*—*For determining the Relations between particular Symptoms and particular morbid Appearances found on Dissection.*

Dissections.	Morbid Appearances.	Signs.	Symptoms. I.	II.	III.	IV.	V.	VI.	VII. &c.
			A.	B.	C.	D.	E.	F.	G. &c.
		a.							
		b.							
		c.							
		d &c.							
	Coincidences of the two Series of Signs.		A.	B.	C.	D.	E.	F.	G. &c.
		a.							
		b.							
		c &c.							

II. *d.*—*For determining the Coincidence of certain morbid Appearances with certain Stethoscopic Signs.*

Dissections.	Morbid Appearances.	Signs.	Stethoscopic Signs. I.	II.	III.	IV.	V.	VI.	VII. &c.
			A.	B.	C.	D.	E.	F.	G. &c.
		a.							
		b.							
		c.							
		d.							
		e.							
		f. &e							
	Coincidence of the two Series of Signs.	*a.*							
		b.							
		c.							
		d &c.							

FORM IV. *a.—For Arranging and Distributing the Results of any Analysis of Diseases, according to the Classes and Sub-Classes to which they belong.*

Classes.		Sub-Classes.			
		a.	b.	c.	d. &c.
A.					
		a.	b.	c.	d. &c.
B.					
		a.	b.	c.	d. &c.
C.					
		a.	b.	c.	d. &c.
D. &c.					

IV. *b.—For Registering and Distributing the Circumstances of any Disease according to their affinity to each other, as determincd by Analysis.*

Classes.			Sub-Classes.					
		Co-efficient.	a.	Co-efficient.	b.	Co-efficient.	c. d. &c.	Co-efficient.
A.								
B.			a.		b.		c. d. &c.	
C.			a.		b.		c. d. &c.	
D.			a.		b.		c. d. &c.	

IV. *c.—For Registering and Arranging the Circumstances of any Disease according to their Classes, as found by Analysis.*

Circumstances arranged in Classes according to their Signs.									
A.	Co-efficient.	B.	Co-efficient.	C.	Co-efficient.	D.E.&c	D.	E.	F.

Particular Histories of Singular or Remarkable Diseases.

Particular Descriptions of any Remarkable Causes or Symptoms of Disease, of the Morbid Appearances on dissection, of the Effects of Medicines, &c. &c.

Analytical Index of the Circumstances of Diseases, Alphabetically Arranged.

Circumstances of	Diseases,	Observed in Cases	of Series.	Page.

Alphabetical Index of Diseases.

Disease,	Species,	Variety,	or Modification	Page.

SECTION II.

Physiology.

That science which has for its object to explain the phenomena of organized bodies, taking Physiology in its most extensive sense, falls very naturally under consideration after Medecine; and may be named with it, as requiring equally the aid of a better Induction: not however that they are to be so much compared with each other as regards the intricacy and complexity of their facts, as in their suffering in common from the neglect of a proper method of investigation. The phenomena of physiology consists of much fewer elementary circumstances which present themselves in an order conveniently arranged for comparison, and admit more frequently of being varied and modified by experiment. Indeed of late years physiology has in some of its branches been almost elevated to the rank of an experimental science, and it cannot be denied that within the same period its progess has been proportionately accelerated. But it must not be

forgotten, that experiments upon organized bodies do not carry with them the conclusive evidence which results from experiments upon unorganized matter, and are sometimes so entangled with the accompanying circumstances that they are even not so decisive as the facts of simple observation. And if we consider for a moment the conflicting opinions which have been deduced from the same experiments, and the numbers of experiments which justify no opinion at all, we may be disposed to admit that a method of analysing experiments is as essential to elicit truth as the power of making them. If we also contemplate the multitude of facts, observations as well as experiments, which remain isolated and unconnected, and therefore sterile, it is impossible not to be convinced that the only way to solve the mysteries of nature, which are of the province of physiology, is by a severe and searching induction; and, therefore, though in the time of Willis it might have been permitted to him to say, after the fable, "*ex aperto cerebro, obstetricantibus etiam Vulcani ferramentis Minervam enatam fuisse*; *nam aut hac viâ scilicet per vulnera et mortes, per anatomiam et quasi cæsareo partu, in lucem prodibit veritas, aut semper latebit,*" in the state of the science in our days, it would be more correct to conclude, in the opinion of the philosopher, "*itaque facienda est corporum separatio et solutio non per ignem certe, sed per rationem et inductionem veram, cum experimentis auxiliaribus;*

et per comparationen ad alia corpora, et reductionem ad naturas simplices et earum formas, quæ in composito conveniunt et complicantur ; et transeundum planè a Vulcano ad Minervam, si in animo sit veras corporum texturas et schematismos in lucem protrahere."

What but the want of a proper method of induction has prevented the vast resources which the physiology of the lower animals afford, from having been made available? The mutual illustrations which the different structure of their organs might throw upon their functions, have been almost entirely neglected, and although, in this way, a simple comparison of observations might frequently impart evidence more conclusive than a direct experiment, this rich mine of physiological treasure has scarcely been turned to any account. As an example of investigating the phenomena of life in this way, I would instance the work of Wepfer on the comparative anatomy of the great sympathetic nerve, and, of the principle, it would be impossible to find a happier explanation than the following passage from Cuvier. "Il consiste à observer successivement le même corps dans les différentes positions où la nature le place, ou à comparer entre eux les différens corps jusqu' à ce que l'on ait reconnu des rapports constans entre leurs structures, et les phénomènes qu'ils manifestent. Ces corps divers sont des espéces d' expériences toutes préparées par la nature, qui ajoute ou retranche à chacun d'eux différentes parties, comme nous

pourrions désirer de le faire dans nos laboratoires, et nous montre elle-même les résultats de ces additions ou de ces retranchemens." And whilst this method of substituting observations for experiments, by means of induction, must prove more agreeable to the kinder feelings of our nature, enabling us to spare many painful sufferings, otherwise of necessity inflicted upon the lower animals, it is encouraging to recollect that the great discovery of the circulation of the blood was principally the fruit of a process of legitimate induction; and that the natural system of the nerves, the most brilliant accession to physiological science made in our days, was chiefly achieved by the same instrument.

The remarks which I have found it necessary to make on the proper method of studying the physiology of the body, apply with equal propriety to the investigation of the phenomena of mind. For although it must be admitted that the present state of the physiology, improperly called the philosophy, of mind, is by no means encouraging, it must also be allowed that it has never been satisfactorily studied as a science of experience; and that if the processes under which philosophers have arranged the intellectual phenomena, afford very inadequate explanations of the mental operations, it must not be forgotten that they have been rather the result of hypothetical anticipations than of legitimate inductions. The luminous facts which nature scatters

so abundantly at our feet, either as instances of the unequal developement of the mental faculties, of the absolute deficiency of some, or of the accidental derangement of them all, instead of being gathered and winnowed for our information and our profit, have been trodden down and neglected; and the light which they might have thrown on the process of the mind, has been smothered or extinguished by the very mass and multitude of the observations. Nor is it merely for the pleasure and satisfaction which the full knowledge of the ways of nature never fails to impart, that this waste of experience is to be so much regretted. They whose lives are spent in using the processes of Nature as the operations of Art, are too deeply impressed with the belief, that, if all art does not, in the language of Hippocrates, literally exist in nature, most certainly the knowledge of nature is the only power of art, not to give a ready admission to the pleasing prospect,—that, if the intellectual sciences we possess are only copies or reflected transcripts of the natural process of the intellect, in the undiscovered operations of the mind, there may remain wrapt up, but yet to be revealed, sciences as unconceived and as unthought of by us as were the wonderful powers of the modern calculus by the great philosophers of antiqiuity.

SECTION III.

PHRENOLOGY, ANIMAL MAGNETISM, AND OMOIOPATHIC MEDICINE.

These subjects have been brought forward with claims to be received amongst the sciences. Whether they be entitled to that rank I dare not pretend to say. As they profess to be derived from experience and appeal to it, they have a right to be heard attentively and to have their cause judged by a fair induction of facts. But as the facts they bring forward are capable of various constructions, without the necessity of admitting the existence of new laws of mind or new agencies of matter, it is obviously incumbent upon those who advocate these branches of knowledge, to subject their facts, without choice or bias, to the test of a searching analysis. It is not by a few selected and solitary instances that such complicated questions are to be set at rest; on this principle, judicial astrology, fortune-telling and necromancy might have equal claims to be entertained.

The *tabular analysis* appears to me very well adapted to the examination of these questions and

I have therefore endeavoured to point out, in tables, some of its applications to Phrenology. But in order that the trial made by these tables may be perfectly fair, it would be proper that the number of individuals upon whom the observations were made should be very considerable, and should be taken indiscriminately; and that the moral and intellectual qualities of each individual should be determined by one party, and the developement of the organs should be described by the other, without any communication having place between them.

FORM I. *a.—For ascertaining* EMPIRICALLY *the relations existing between the external form of the Head, and the Moral and Intellectual Faculties.*

External Configuration of the Skull according to the Phrenologists; Moral and Intellectual Qualities by Observation.		Classification of the Signs.					Individual Observations.									
		A.	B.	C.	D.	E &c.	I. A.	II. B.	III. C.	IV. D.	V. E.	VI. F.	VII. G.	VIII. H.	IX. I.	X. &c. K. &c.
Organs.																
Moral and Intellectual Qualities.																

I. *b.—For determining the coincidence of certain Configurations of the Head with the Moral and Intellectual Faculties as assigned by Phrenologists.*

External Configuration of the Skull according to the Phrenologists.	Classification of the Signs of the Protuberances.					Individual Observations.					Classification of the Signs of the Moral and Intellectual Faculties.					Moral and Intellectual Faculties, as observed in Indivduals.
	A.	B.	C.	D.	E. &c.	I. A.a	II. B.b.	III. C.c.	IV. D.d.	V. &c. E.e. &c.	a.	b.	c.	d.	e. &c.	

II. *a.—For determining the coincidence of the external Configuration of the Skull, according to Phrenologists, with the Moral and Intellectual Qualities.*

Names of Individuals on whom the Observations were made.	Moral and Intellectual Qualities.		Protuberances of the Organs.								
			I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX. &c.
	No.	Signs	A	B	C	D	E	F	G	H	I &c.
	I.	*a.*									
	II.	*b.*									
	III.	*c.*									
	IV.	*d.*									
	V.	*e.*									
	VI.	*f.*									
	VII.	*g.*									
	VIII.	*h.*									
	IX.	*i.*									
	X.	*j.*									
	XI.	*k.*									
	XII.	*l.*									
	XIII.	*m.*									
	XIV.	*n.*									
	XV.	*o.*									
	XVI.	*p.*									
	XVII.	*q.*									
	XVIII.	*r.*									
	XIX.	*s.*									
	XX.	*t.*									
	XXI.	*u.*									
	XXII.	*v.*									
	XXIII. &c.	*w.* &c.									
Coincidence of the two Series of Signs.											

SECTION IV.

THE USEFUL ARTS, CHEMISTRY, AND METEOROLOGY.

When the useful arts are practised by observing and independent minds, their history presents a constant and continued series of inductions which the tangible and visible nature of their operations forces upon the understanding, and hence they are ever steadily, though gradually, advancing forward. It is for the same reason, that men, whose minds are open to observe and free to think, habitually occupied in the practice of an art, and unconsciously exercised in the inductive process, are distinguished by that intuitive common sense *(abnormis sapiens,—crassâ Minervâ)* which is acknowledged to belong to practical men. But on the contrary, where the rule of procedure in an art is immoveably fixed, and where the artist may not change or adapt the rule to the circumstances, he himself becomes degraded to a machine of slavish imitation, and his art may retrograde but cannot improve. It is, therefore, the proper exercise of induction which makes the able and the skilful

artisan, and which ensures the improvement of the arts. The history of the progress of the useful arts in different countries might afford some interesting illustrations of this opinion. Thus the Chinese seem for centuries to have been following in the practice of their arts a process of pure imitation, presenting as it were the experiment of a whole people pursuing the method of the *experientia literata* instead of the *experientia vera.* It is, therefore, not difficult to understand why, with all the patient manipulating practice of their arts, they have never chanced to stumble upon a science. The Greek artist, in ancient, and the English mechanic of modern times, may on the contrary be fairly said to have taken the lead of all others in the practice of intuitive induction, and it is unnecessary to add that the results have been in correspondence. This consequence of the liberty of thought, in the daily practice of the useful arts, has perhaps not been fully appreciated, and this view of the tangible nature of the intuitive induction of the arts, may afford a way of explaining the difference between the progress of the arts and of philosophy, not precisely the same as that suggested by Bacon.—*Artes enim mechanicas ut auræ cujusdam vitalis participes quotidiè crescere et perfici; philosophiam verò statuæ more adorari et celebrari nec moveri. Atque illas in primis auctoribus rudes et ferè informes ac onerosas se ostendere; posteà novas vires et commoditates adipisci: hanc autem in primo quoque*

auctore maximè vigere, ac deinceps declinare. Neque aliam hujus contrarii successus causam veriorem esse, quam quod in mechanicis multorum ingenia in unum coëunt, in philosophia autem singulorum ingenia ab uno quopiam destruuntur.

The experimental nature of Chemistry, as I have already had occasion to remark, renders it comparatively independent of the mental analysis. In the decomposition of substances, the principle of exclusion is applied in the same manner practically, as it is performed by the understanding upon the objects of thought, and the privilege of experiment allowing of, as it were, the creation of *prerogative facts*, or such as have a decided bearing upon the subject of investigation, the conclusion is suggested, not sought for. There are, however, some departments of this science where experiments are not such luminous facts, or where they possess their distinctive character in so low a degree, that they afford evidence scarcely more conclusive than that of simple observations, so that the truth can only be ascertained by accumulating the evidence of numerous instances. I allude to the analysis of organic bodies, to animal and vegetable chemistry, in which it is only by the intellectual analysis of numerous experiments that we can expect to arrive at satisfactory and lasting results.

After Medicine and Civil Polity, the phenomena which are the object of Meteorology, are probably

those which are the result of the combination of the greatest number of elements; and, unlike either of the subjects which have just passed under consideration, their combinations are matter of pure observation, which no artificial cause can change or modify. It is, therefore, unnecessary to say, that the laws which govern these phenomena can only be ascertained by faithful histories of their combinations, and by careful and cautious conclusions, deduced from them. Now, though we do certainly possess very accurate records of atmospheric phenomena, (and amongst the patient and persevering labourers in this field of science, no one is more deserving of mention than the modest Howard*,) yet to place all the elements of these phenomena,—all the circumstances which compose the observations, in their natural relation to each other, is beyond the reach of the ordinary method of induction. Nor does it seem probable, that this manner of investigating the laws which controul atmospheric phenomena, can ever be superseded or supplied by the indirect method of hypothesis,—by applying to explain them, the relations of heat, light, moisture, evaporation, &c., as ascertained in the laboratory; so that, unless some *method of experience* can be made equal to cope with the complexity of the subject, there is small chance of success. But the only form of induction which has heretofore been made use of in drawing conclusions

* *(Climate of London.)*

from meteorological facts, (from which it has sometimes been possible to guess at a few indistinct, glimmering relations, connecting together some of the different elements of the phenomena,) has been mere enumeration,—a blindfold induction. It is, therefore, in subjects of this description, that the tabular analysis, which not only enumerates but excludes, if aided and sustained by assiduous observation, promises more favourable results; whether directed to discover the laws which govern meteorological phenomena, or to determine, from the present phenomena of the atmosphere, those which are to follow.

But, to apply these remarks to their object, we may easily gather from a comparison of the foregoing subjects, in nature differing so much from one another, that whether we are labouring in the daily toils of the Arts, or keenly seeking to penetrate the mysteries of Nature, by the most ingeniously devised experiments, or, patiently and passively, watching and waiting for the slow succession of natural phenomena, our success chiefly depends on the skilful use we make of our inductive powers, either unconsciously or intentionally exercised.

SECTION V.

CLASSIFICATIONS OF NATURAL HISTORY.

The method of tabular analysis promises to be of much assistance in the study of Natural History, in abbreviating and facilitating the process of systematic arrangements; for classification and method forming the essential part,—indeed constituting the whole, of this process of Induction, it readily lends its aid to such pursuits. The objects *(instances)* being submitted to the operation of the analytical tables, are decomposed mentally, and reduced to their simplest forms and properties *(circumstances)*, which are afterwards assorted and distributed according as they may be common to all the objects, as they may belong only to a few, or be confined to some particular one. This at once shows what are the properties which constitute the generic character, what go to the specific distinctions, and what remain for the individual peculiarities. But the classifications of natural history,—rather classifications of *instances* than of *circumstances*, are, properly speaking, only incomplete inductions in which the

first stage of that process, *classification by affirmative circumstances,* has only been performed. There is reason, therefore, to hope that were this operation carried a step farther,—were the classifications of natural history subjected to the process of exclusion or *classification by negative circumstances,*—our knowledge of nature would be greatly advanced, and the distinction of Natural History into *systematical* and *philosophical,* or *physiological,* would no longer exist.

A classification of instances, or objects, can only be founded on a correct classification of their circumstances or properties. From the process of *classification by affirmative circumstances* proceeds, therefore, the classification of instances as well as the process of exclusion, *classification by negative circumstances;* the stream of knowledge dividing itself, at this point, into two branches; the one pursuing, the investigations of causes, ascertaining the circumstances which *cannot be separated;* the other collecting the long series of existences, determining what circumstances *may be conjoined.* The following imperfect sketch will explain the application of this method to the classification of instances.

FORM. V. *Classification of Instances.*

Instances.	Classifications of Circumstances.									Classification of Instances.								
	A	B	C	D	F	H	K	M	T	Genus.	1. Species.	*a.* Variety.	*b.* Variety.	2. Species.	*a.* Variety.	*b.* Variety.	3. Species.	*a.* Variety.
A.	A									A.								
B.	A	B								A.	B							
C.	A		C							A.				C				
D.	A	B		D						A.	B	D						
E.	A						K	M		A.							K	M
F.	A		C		F					A.				C	F			
G.	A						K			A.							K	
H.	A	B				H				A.	B		H					
I.	A	B				H				A.	B		H					
J.	A		C		F					A.				C	F			
K.	A						K			A.							K	
L.	A	B		D						A.	B	D						
M.	A	B				H				A.	B		H					
N.	A		C		F					A.				C	F			
O.	A						K			A.							K	
P.	A						K	M		A.							K	M
Q.	A		C		F					A.				C	F			
R.	A	B				H				A.	B		H					
S.	A									A.								
T.	A		C						T	A.				C		T		
U.	A									A.								
&c.	A																	

SECTION VI.

ANALYSIS OF TESTIMONY.

Facts testified differ from facts of personal experience in having passed through media,—mind and language, by which, like objects seen through optical instruments, they are liable to be misrepresented. The correctness of such an instrument,—the credibility of a witness—can only be ascertained by observing whether the object is represented consistently with general experience, whether similar instruments,—witnesses of the same facts,—coincide in the appearance which they give to the object; or, if, as in *vivâ voce* evidence, the opportunity be allowed of taking the instrument to pieces, of examining its different parts, and of changing and inverting its position,—by determining whether the object continues to be presented in a manner consistent with the different aspects under which it is viewed. This last is the method of cross-examination, where the examiner, like the experimenter in physicks, has the advantage of creating *prerogative* facts, and is consequently the most searching test of testimony.

The agreement of testimony with general experience,—that which every day testifieth or common consent acknowledgeth, is of great weight where the testimony concerns natural facts, but is also a test of testimony which is liable to great abuse. For men being disposed to limit experience to their own knowledge, or to mistake one for the other as if convertible terms, are either ready to believe a falsehood because they understand it, or to reject what is true, because they cannot comprehend it. There are many instances of truths, from this cause, having been left for centuries out of the pale of science, and of falsehoods having been, for the same reason, installed in undisputed possession. The history of meteoric stones affords a good example where the truth of testimony was for centuries rejected, because the facts could not be explained by science, but where the force of testimony at last prevailed in establishing facts which a more perfect science afterwards explained and confirmed. It would indeed be difficult to say how much the world has lost in experience by the pride of knowledge. One of the most recent instances which occurs to me, is the use of cupping glasses in the treatment of poisoned wounds; a practice followed by the ancients, which fell into disuse because it was not understood, and which has, only lately, been revived, because experiments have explained that the absorption of poison is by that expedient prevented.

Where there is neither the opportunity of cross-

examination nor the test of experience, there remains no way of judging of the credibility of witnesses of the same facts but by comparing their evidence with one another.* But when the question is much complicated and the witnesses numerous, it is no easy matter to confront them accurately, to collect from the different testimonies, the bearings of all upon the points at issue, so that each may carry its proper weight and no more. It is, therefore, this part of the analysis of testimony which, it appears to me, might derive much assistance from the method of classification. For, by arranging and methodising the testimonies of different witnesses according to the plan of an analytical table, the classified signs would not only concentrate the strength of the whole testimony, but would point out where the evidence of any one was defective or contradictory. The facility which this plan affords of classifying and comparing together the individual circumstances of facts, testified by different witnesses, has many advantages over the same operation performed *memoritèr*, and shows the coincidencies and discrepancies more clearly and distinctly than the ordinary method of writing

* In a question which at this moment divides the scientific world, the spontaneous motion of the atomic particles of matter, our simile has become matter of fact; for the point in dispute hinging entirely upon the correctness of the microscopes,—the credibility of the witnesses,—can only be decided by a comparison of them.

down in notes the heads of the evidence. For, by the operation of the analytical table, the evidence of numerous testimonies, however intricate or difficult to unravel, might be arranged, set in order, and at last classified, so as to represent their true relations to each other and to the points to be determined; and it seems possible to make even the credibility of a witness enter as a circumstance into each individual testimony, so that it may receive its due estimation and no more.

The same facility which this method affords for the analysis of facts certified by many individiuals, it also presents for orderly digesting the various opinions held by different individuals upon the same question. Thus in the debates of public assemblies where men assign the reasons of their votes and opinions, it is most difficult to understand all their relative bearings, and it is not uncommon to find persons contending, with the same arguments on opposite sides of the same question. It would surely be therefore of great assistance to have the debates of such public bodies correctly analysed, to see the reasons of either side distinctly arrayed against each other, and to understand the bearing of every individual reason, and the reasons of every individual member upon the question at issue.

FORM I. *a.—For ascertaining in what Circumstances a number of Testimonies agree together.*

Circumstances testified.	Classification of the Signs.								Testimonies.									
									I.	II.	III.	IV.	V.	VI.	VII.	VIII	IX.	X.
	A	B	C	D	E	F	G	H	A.	B.	C.	D.	E.	F.	G.	H.	I.	J.&c.

I. *b.—For comparing with one another,* collectively, *two series of Testimonies on opposite sides of the same question.*

Circumstances testified.	First Series. Classification of the Signs.					Testimonies. I.	II.	III.	IV.	V.	Testimonies. I.	II.	III.	IV.	V.	Second Series. Classification of the Signs.					* Circumstances testified.
	A	B	C	D	E &c.	A	B	C	D	E &c.	A	B	C	D	E &c.	A	B	C	D	E &c.	

I. *c.—For comparing with one another,* individually, *two series of Testimonies on opposite sides of the same question.*

Circumstances testified.	First Series. Classification of the Signs.					Testimonies. I.	II.	III.	IV.	V.	VI.	Second Series. Classification of the Signs.					Circumstances. testified.
	A	B	C	D	E &c.	A.a.	B.b.	C.c.	D.d.	E.e.	F.f. &c.	a	b	c	d	e &c.	

II. *a.—For ascertaining the bearing of a series of testimonies on certain Circumstances.*

Testimonies.	Signs.	Circumstances. I.	II.	III.	IV.	V.	VI.	VII.	VIII &c.
	A.								
	B.								
	C.								
	D.								
	E.								
	F.								
	G. &c.								
Classification of the Signs.	A.								
	B.								
	C.								
	D. &c.								

II. *b.—For ascertaining the coincidence of two series of Testimonies concerning certain Circumstances.*

Testimonies of First Series.	Signs.	Circumstances. I.	II.	III.	IV.	V.	VI.	VII. &c.	Signs.	Testimonies of Second Series.
	A.								*a.*	
	B.								*b.*	
	C.								*c.*	
	D.								*d.*	
	E. &c.								*e. &c.*	
Coincidence of the Signs.										Coincidence of the Signs.

SECTION VII.

STATISTICS AND POLITICAL ECONOMY.

Quotus enim quisque novit, ægroto mortuo aut restituto, item *republicâ stante vel labante,* utrum sit res casûs an consilii?

If the true object of Statistics were attained, they would constitute the most luminous commentary upon the wisdom of particular governments; for, affording the truest means of tracing effects to their causes in the body politic, they would form the safest criterion for estimating the relative merits of different institutions. If the materials of Statistics were faithfully and accurately prepared and clearly analysed, they would present the experimental result of legislation in all its various departments; for, allowing effects to be placed in relation with their causes, they would enable us to distinguish that which is constant from that which is accidental,

—the consequence of positive enactment from that of collateral and intercurrent causes. In short, Statistics properly studied would be constantly preparing the means for making legislation a science, and would thus remove that censure which, since the days of Count Oxenstiern, has been so freely reported of those who administer public affairs.

In the complicated machinery of the body politic, a law is frequently a very subordinate element in producing the series of circumstances which succeed it, but being probably the only element which is the result of design, it is generally regarded as the sole cause. Were the statistics of the case, or the circumstances which accompanied the operation of the law, correctly ascertained and fairly analysed so that all stood in their natural relation to each other, it might then be just to say what were the real consequences of any law, and what were foreign to it; and the biassed opinions of interest or party would cease to mislead us under the name of Experience. The present state of statistics is far from corresponding to these views. The information which they yield is vague and unsatisfactory, a few general incongruous conclusions, the effects of many causes without a particular reference to any one. Even these are confined for the most part to subjects which admit the measure of number and quantity, and only speak in the dry language of

figures: or, on the other hand, some of those questions which most interest the feelings of society, for want, it must be allowed, of better means, are treated like matters of finance. The crimes of a community are estimated in percentages,—their murders in ratios,—their suicides and executions in decimals and fractions, to which are appended some clumsy speculations and much difference of opinion concerning their causes and their effects, but without any fair and rational appeal being made to experience, with any reasonable prospect of ascertaining the truth. We learn nothing,—at least nothing which is entitled to the least confidence, concerning the influence of circumstances, of parentage, early habits, education, religion, natural propensities, bodily health, trade and occupation, and many other possible causes the knowledge of which might lead to the remedy. Yet all and every one of these are objects of common observation and of legitimate inquiry which remain unanswered only for want of a proper method of asking the questions. And until some method is found of obtaining satisfactory answers to such questions, all hopes of enlightened government must be despaired of, and legislation must remain, as it is, the most empirical, though the most important, of all the sciences.

The meritorious efforts of public spirited individuals, in collecting information on many subjects intimately connected with the welfare of the

country, are fully entitled to respect, and nothing can be more to be regretted than that they should have been attended by such unsatisfactory results; or that their labours were not directed by a better method. For though the shelves of the public offices have been loaded with the lumber of returns, (of which, a single sheet of information, analytically collected and digested, would have contained the essence of a cart load); so faulty and deficient has been the method of collecting it, that it leads the inquiry to no conclusion, and, in spite of the best intentions and most praiseworthy perseverance, the fruits of experience never ripen to a state of usefulness. But I cannot help indulging the hope, which I must confess to me is matter of some satisfaction, that were the method of induction by classification applied to statistical researches, many of these deficiencies might be supplied and much valuable experience, which is at present cast away, might be rendered fruitful and profitable. By means of analytical tables consructed upon this principle, and properly adapted to each subject, information might be gathered together in such a form, that, the relative influence of every circumstance bearing upon the subject of inquiry, would at once present itself; effects would be found in correspondence with their causes; and the conclusion, instead of being swayed to the right or to the left, by the bias of preconceived opinions, would be drawn

by a simple mechanical operation. It would require no great labour to prepare analytical forms to serve the purpose of registers, records, lists, journals or diaries, in such a way that the information which is perpetually produced by the ordinary and every-day working of the machinery of public institutions, might be preserved, collected, and analysed, and be made to be unceasingly contributing to a common stock of available experience. Were the organization of our public institutions formed on an inductive principle, or were a system of analytical machinery attached to our public offices, to our courts of law, prisons, houses of correction, work-houses, penitentinaries, hospitals, lunatic asylums, and all public establishments, to record, methodically, every operation, a vast fund of knowledge would be placed at our disposal, all in some way or other conducive to the public good. And if the analytical machinery of all such institutions were placed in correspondence with one central board of Statistics, constituted of men of science, by whom should be performed the last refining process of the materials, the best check would be provided for the careful discharge of administrative duties, the most common and ordinary operations of public institutions would be fraught with knowledge as well as use, *(experimenta et fructifera et lucifera,)* and the whole would be laying a broad and lasting foundation for the superstructure of political science.

The fear only of encumbering this little work with too many forms of tables, has led me to omit their particular application to Statistics and Political Economy, but whoever will take the pains to understand this principle of classification, will find little difficulty in adapting it to any subject.

CONCLUSION.

It would be an easy matter to increase the number of the applications of the tabular analysis, for only a few examples have been given of the many snbjects which demand the aid of a better induction, though, perhaps, sufficient have been already mentioned to fulfil the object of this little work—to urge, to insist upon, a better use of experience—to promote the adoption of an easier, a surer, method of obtaining it. If, however, any one should be disposed to refuse assent to the proposition which I have advanced—that the sciences of observation are almost brought to a stand for want of a proper method of experience—I shall be happy to find that he is ready to assign a better reason for their imperfect state, or one which may lead us to the goal by a shorter road. And if any one be inclined superciliously to reject the method I have proposed, because of the meanness of the apparatus, I trust he is prepared with one of more finished workmanship; nor shall I be either surprised or dissappointed to find, that, in this branch of science, the homely

contrivance of the distaff and spindle has been superseded by the more powerful machinery of the spinning-jenny. But deeply impressed with the imperfect manner in which this work has accomplished its object, and sensibly alive to the vast importance of the subject, I cannot take my leave of it without repeating my conviction that the sciences of observation are either starved or surfeited through the neglect of the Baconian Logic—through the too light estimation of that art which teaches how to *discover* the truth, as the Aristotelian should teach us how to *use* it. For I will venture to hazard the opinion, that when a tithe of the time has been spent upon the one, which has been mis-spent upon the other,—when a grain of the labour has been bestowed on the method of discovery, which has been thrown away upon the method of syllogism,—when the inductive logic shall have received that perfection and that precision of which it is capable,—Experience will become an open book, easy to read, and ready to be understood; purified of its false texts and double senses, and admitting only one construction, it will then prove the sure and unerring guide, for which it seems to have been intended by the great disposer of all things,—not only the planet to light and to direct the path of the philosopher through the boundless expanse of nature, but the monitor to teach and to advise the unlettered, as well as the learned, how to make the best use of

all his bountiful endowments. But, whilst time is slowly bringing forth this happy æra, I must rest satisfied with having lent my best endeavours to a good cause, and, contented to bear away the lowly reward of a pioneer in so great a work, I shall learn, even in present failure, to console myself with the reflections of a very great master: "In an inquiry, it is almost every thing to be in a right road. I am satisfied I have done but little by these observations considered in themselves; and I never should have taken the pains to digest them, much less should I have ever ventured to publish them, if I were not convinced that nothing tends more to the corruption of science than to suffer it to stagnate. These waters must be troubled before they can exert their virtues. A man who works beyond the surface of things, though he may be wrong himself, yet he clears the way for others, and may chance to make even his errors subservient to the cause of truth."*

* Burke.

FEB 2 - 1949

LIBRARY OF CONGRESS
0 021 063 278 5